On Track 5

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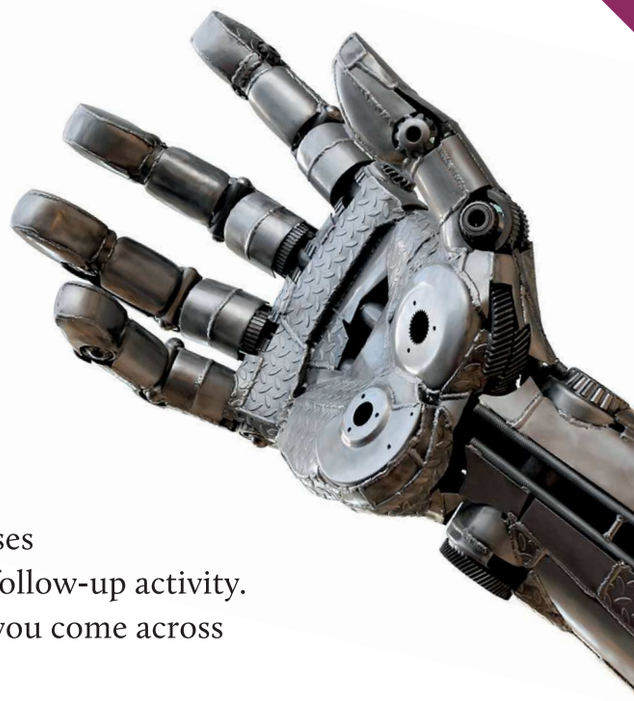
Kopiointiehdot
Tämä teos on digitaalinen oppikirja, joka on suojattu tekijänoikeuslailla (404/61).

Foreword

Our journey continues. *On Track 5* will transport you into the world of science and technology.



While studying remember to be an active learner. The following exercise types will help you.

Personal dictionary exercises support you in expanding your range of vocabulary.

Reading comprehension exercises after the text aim to open the text for you. By doing these exercises you learn to read critically, look for specific information and sometimes read between the lines.

Phrase hunt exercises activate you to look up useful phrases from the texts. These phrases are always practised in a follow-up activity.

Vocabulary exercises help you revise the vocabulary that you come across in the texts.

Listening exercises help you sharpen your listening skills, and familiarise you with a variety of accents and speaking styles.

Speaking activities: Do not worry about your accent, just speak! The more you practise speaking, the easier it will be to meet and interact with people.

Writing: When you write you have time to plan and organise your thoughts neatly into sentences and paragraphs. The more you write the better you become, even if no one checks your writing.

Enjoy the journey

To get the most out of your trip, remain active and take those extra detours that inspire you. Watch English-language films and videos, read blogs, books, ads, news articles and speak English as often as you can.

Learning happens when you make it happen.

COURSE 5

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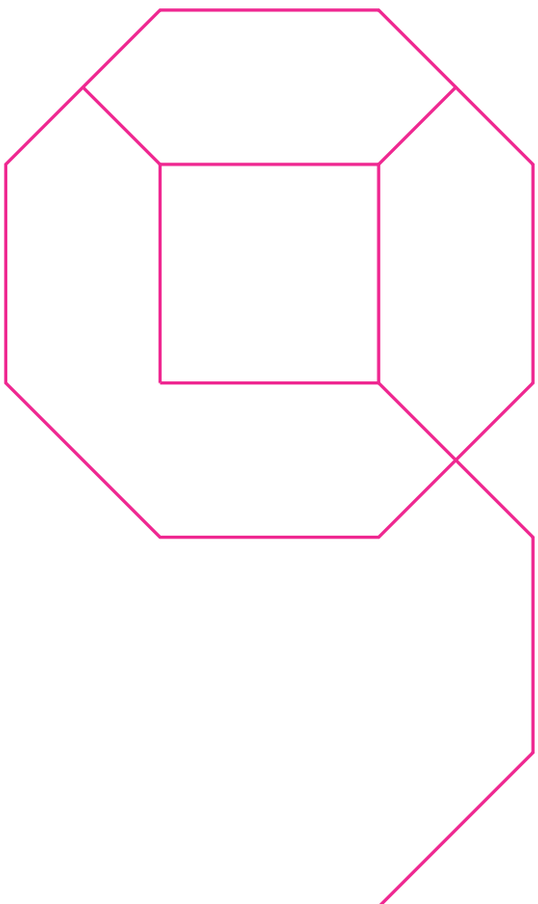

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Precourse

Science and technology: text types

A Read through the extracts below. Can you guess the type of texts each one is taken from? Match the extract with the text type. The first one has been done for you.

1	book review	6	psychology experiment
2	news report	7	joke
3	novel	8	food label
4	physics textbook	9	lyrics
5	PhD thesis	10	instructions on packet

4 A

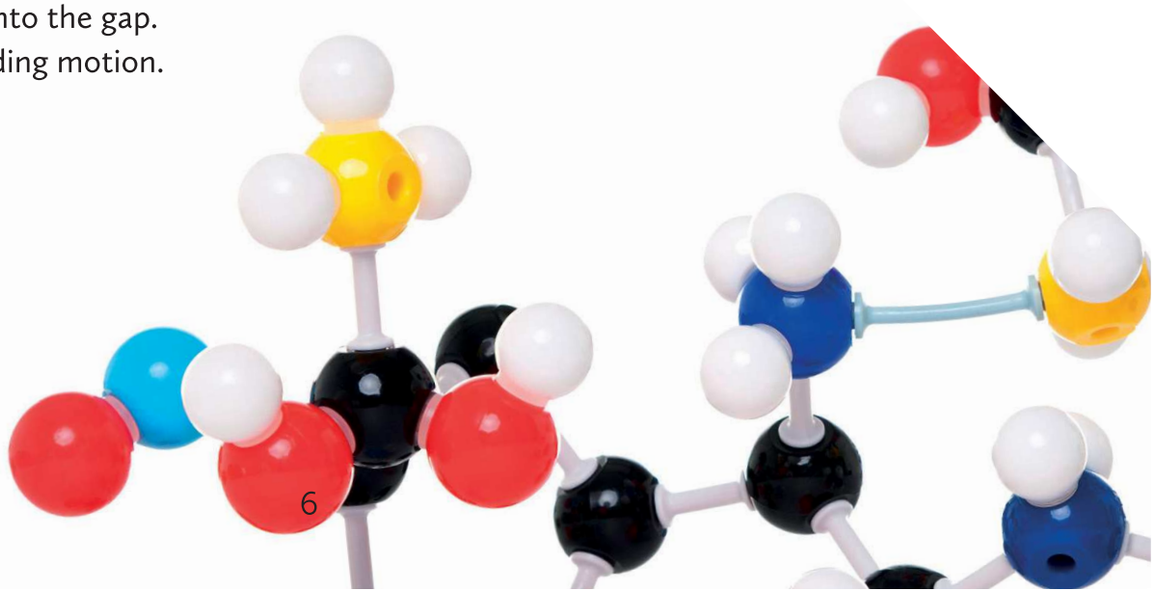
When light (or any other electromagnetic radiation) falls on a metallic surface, electrons may be emitted from that surface in a phenomenon known as the photoelectric effect.

B

Typical values	100g contains	Reference intake for an average adult
Energy	985kJ	8400kJ
Carbohydrate	45.5g	90g

C

1. Detach a length of about 25 cm.
2. Wrap the ends around the two index fingers.
3. Tighten the string.
4. Gently insert into the gap.
5. Use careful sliding motion.



☐ **D**

First, we prove a Landau-type formula for an exponential sum over the eigenvalues of the Laplacian in PSL(2, Z)\H by using the Selberg Trace Formula. Next, we look at lattice point problems in three dimensions...

☐ **E**

Science, my lad, is made up of mistakes, but they are mistakes which it is useful to make, because they lead little by little to the truth.

☐ **F**

A proton walks into a bar and orders a pineapple juice.
"You're sure?" asks the barman.
The proton sighs and says, "I'm positive."

☐ **G**

Google has patented a sticky coating for driverless cars that could reduce damage done to pedestrians in the event of a collision. People struck by the vehicle would become glued to its bonnet, rather than being thrown off and further injured. "It does have some merit to it," said Andrew Morris, Professor of Human Factors in Transport Safety at Loughborough University.

☐ **H**

You better watch out you better beware
Albert said that E equals M C squared
Einstein A Go-Go
Einstein A Go-Go
Einstein A Go-Go

☐ **I**

As someone who has read more than his fair share of maths books, I was glad to see Bellos covering plenty of material that was new to me. For example, did you know that 60% of measurements and statistics start with a 1, 2 or 3?

☐ **J**

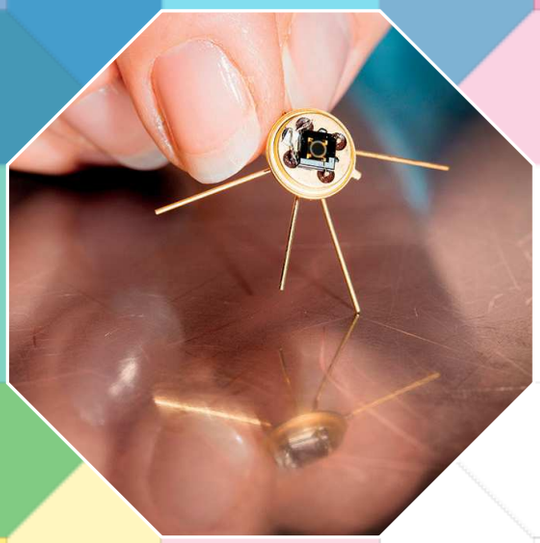
The study was carried out at school during a regular lesson to minimise external variables. Participants were randomly divided into two groups that were separated on opposite sides of the classroom.

B Strange but true. Truth is sometimes stranger than fiction. Look at the following statements. Are they true or false? Tick the boxes. Guess if you don't know! Then listen to the quiz programme and check your answers.

		True	False
1	The strongest bone in your body is the mandible.	☐	☐
2	A potato has more chromosomes than a human does.	☐	☐
3	There are more atoms in a teaspoonful of water than there are teaspoonfuls of water in the Atlantic Ocean.	☐	☐
4	If there were a hole through the centre of the Earth, it would take you 24 hours to fall all the way to the other side.	☐	☐
5	If you built a tower of all the LEGO blocks ever made, putting them one on top of another, the tower would be double the distance to the moon.	☐	☐

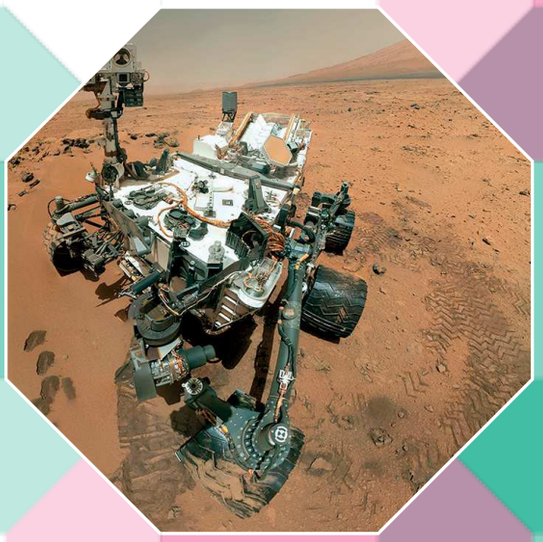
mandible leukaluu

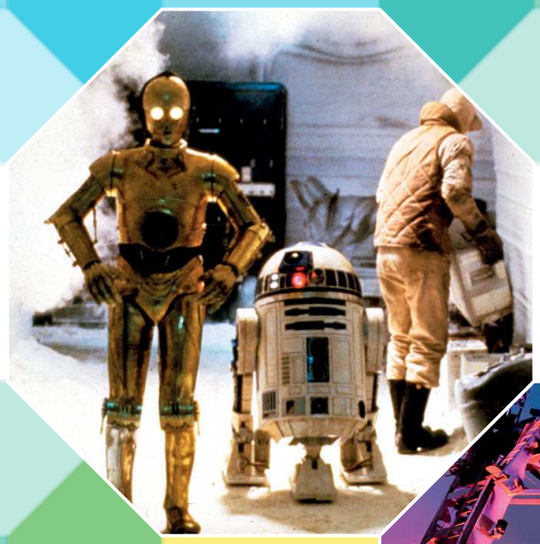
A LEGO London Bridge.



UNIT 1

Other worlds





Topic 1

The Martian

Two things are infinite: the universe and human stupidity;
and I'm not sure about the universe.
(Albert Einstein, physicist)

1A **Take the following quiz to test how much you know about the Red Planet. Feel free to use the internet to help you.**

1 Mars is the _____ planet from the Sun.
a) second
b) third
c) fourth

2 The Martian atmosphere is mostly composed of which gas?
a) hydrogen
b) carbon dioxide
c) oxygen

3 How long does it take to get to Mars?
a) six weeks
b) six months
c) six years

4 How long is a day on Mars?
a) 12 hours 40 minutes
b) 24 hours 40 minutes
c) 40 minutes

5 Mars is named after which Roman God?
a) the god of war
b) the god of love
c) the god of sunburn

6 What can be found at both poles of Mars?
a) American flags
b) oceans
c) ice caps

7 Mars is also called the Red Planet. What causes this colour?
a) iron oxide on its surface
b) a high surface temperature
c) red rain

8 Which of the following statements about Mars is incorrect?
a) Mars has no magnetic field.
b) Mars is home to the tallest mountain in the solar system.
c) Mars inspired the inventor of the Mars bar to create his famous candy bar.

1B **A trip to Mars. You have volunteered for a scientific expedition. You and your group will be taken to Mars where you will live for one year before returning to Earth.**

You have the basics you will need for survival. What personal items would you take with you? First, make an individual list of five things. Then, explain the reasons for your choices to the rest of the group.

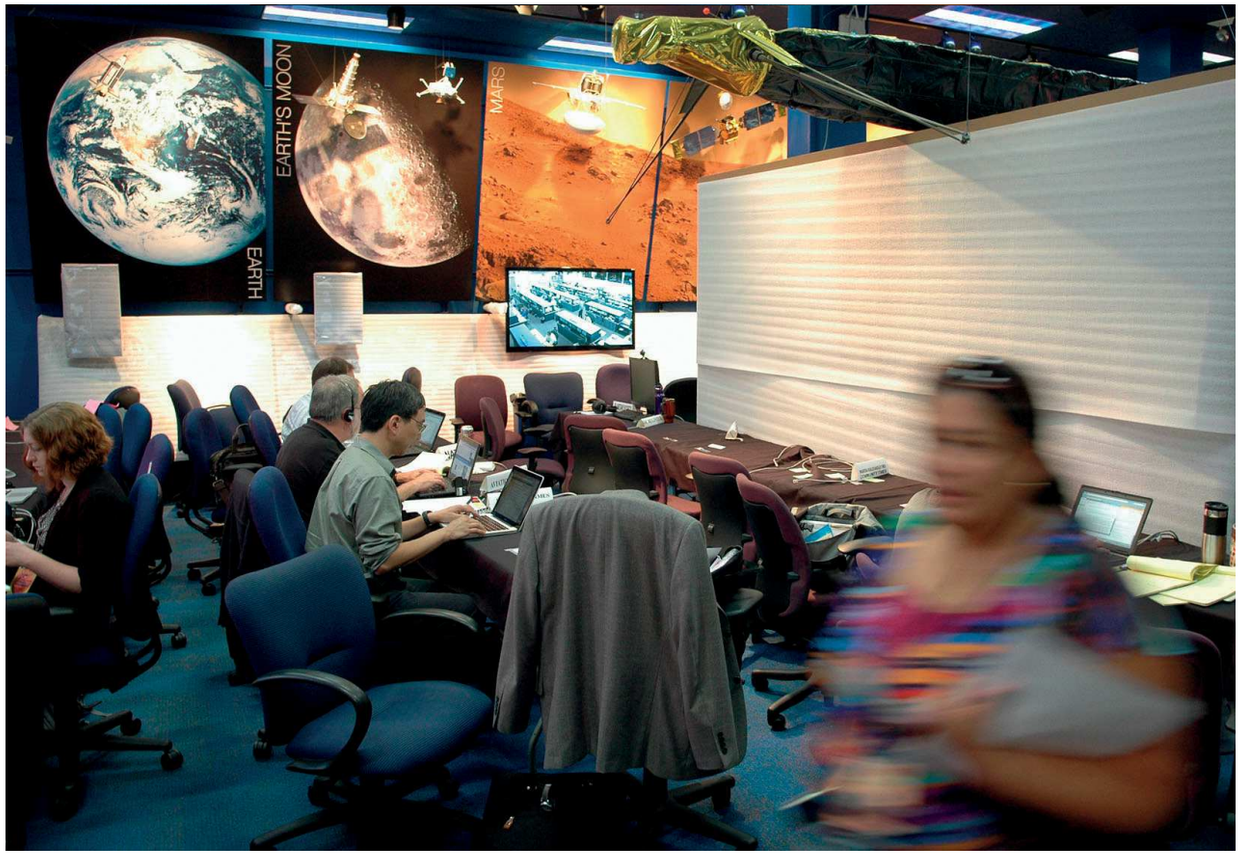
Example

My first object would be a family photo.
Next, I decided...
And then I chose...
I'd also like...
Finally, I thought...

HOW TO

How to justify

The reason this is important to me is...
Why would I want this? Well...
This is important because...
This is a must for me because...



Personal dictionary

1C **Increasing your personal vocabulary bank is one of the most important goals of learning a language. The more words you know, the more you will understand, and the better you will express yourself.**

Make sure you know the following words from text 1. First guess the meaning, then look them up in the vocabulary app if necessary. Write down the Finnish translations in the text vocabulary list on p. 17.

- Choose 3–5 extra words and mark them, too.
- Try making sentences with some of the words.

1 hardwired
2 rugged
3 lunatic
4 vessel
5 atmospheric
6 core
7 distillery
8 abundance
9 evolve
10 ominous

HOW TO

How to pronounce certain adjectives that end in -ed.

The Martian landscape is described as "rugged". The last syllable of this adjective is pronounced [id]. It belongs to a group of adjectives that all have a similar ending when pronounced.

Examples
crooked, jagged, naked, ragged, sacred, wicked

Topic 1 Key text

Destination Mars

Humankind was born in Africa. But we didn't remain there. Over thousands of years our ancestors wandered across the continent, and then out of it. When they came to the sea, they built boats and sailed vast distances to islands they could not have known were there. The urge to know what lies beyond the horizon is something that is hardwired into us. It is the reason we have scaled Everest, crossed Antarctica, plumbed the ocean depths, and landed on the Moon. That same curiosity will one day take us to Mars.

Andy Weir's novel, *The Martian*, imagines a manned mission to Mars. At the beginning of the story one of the astronauts, Mark Watney, is accidentally stranded on the Red Planet. His efforts to survive are chronicled through a series of log entries. In this part of the story he is explaining the harshness of the Martian environment. →

8 Tips for surviving on Mars

So you want to live on Mars. Perhaps it's the rugged terrain, beautiful scenery, or vast natural landscape that appeals to you. Or maybe you're just a lunatic who wants to survive in a lifeless, barren wasteland. Whatever your reasons, there are a few things you should know:

1 You're going to need a pressure vessel.
Mars's atmospheric pressure is less than one percent of Earth's. So basically, it's nothing. Being on the surface of Mars is almost the same as being in deep space. You had better bring a nice, sturdy container to hold air in. By the way, this will be your home forever. So try to make it as big as you can.

2 You're going to need oxygen.
You probably plan to breathe during your stay, so you'll need to have something in that pressure vessel. Fortunately, you can get this from Mars itself. The atmosphere is very thin, but it is present and it's almost entirely carbon dioxide. There are lots of ways to strip the carbon off carbon dioxide and liberate the oxygen. You could have complex mechanical oxygenators or you could just grow some plants.

3 You're going to need radiation shielding.
Earth's liquid core gives it a magnetic field that protects us from most of the nasty crap the sun pukes out at us. Mars has no such luxury. All kinds of solar radiation gets to the surface. Unless you're a fan of cancer, you're going to want your accommodations to be radiation-shielded. The easiest way to do that is to bury your base in Martian sand and rocks. They're not exactly in short supply, so you can just make the pile deeper and deeper until it's blocking enough.

4 You're going to need water.
Again, Mars provides. The Curiosity probe recently discovered that Martian soil has quite a lot of ice in it. About 35 liters per cubic meter. All you need to do is scoop it up, heat it, and strain out the water. Once you have a good supply, a simple distillery will allow you to reuse it over and over.

5 You're going to need food.
Just eat Martians. They taste like chicken. →

6 Oh, come on.

All right, all right. Food is the one thing you need that can't be found in abundance on Mars. You'll have to grow it yourself. But you're in luck, because Mars is actually a decent place for a greenhouse. The day/night cycle is almost identical to Earth's, which Earth plants evolved to optimize for. And the total solar energy hitting the surface is enough for their needs.

But you can't just grow plants on the freezing, near-vacuum surface. You'll need a pressure container for them as well. And that one might have to be pretty big. Just think of how much food you eat in a year and imagine how much space it takes to grow it.

Hope you like potatoes. They're the best calorie yield per land area.

7 You're going to need energy.

However you set things up, it won't be a self-contained system. Among other things, you'll need to deal with heating your home and greenhouse. Mars's average daily temperature is -50C (-58F), so it'll be a continual energy drain to keep warm. Not to mention the other life support systems, most notably your oxygenator. And if you're thinking your greenhouse will keep the atmosphere in balance, think again. A biosphere is far too risky on this scale.

8 You're going to need a reason to be there.

Why go out of your way to risk your life? Do you want to study the planet itself? Start your own civilization? Exploit local resources for profit? Make a base with a big death ray so you can address the UN while wearing an ominous mask and demand ransom? Whatever your goal is, you had better have it pretty well defined, and you had better really mean it. Because in the end, Mars is a harsh, dangerous place and if something goes wrong you'll have no hope of rescue. Whatever your reason is, it had better be worth it.

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ancestor /ænsestə(r)/ esi-isä
vast /vɑːst, væst/ valtava, laaja, avara
urge /ɜːdʒ/ halu
hardwired /hɑːdwaɪəd/

---

scale /skeɪl/ kiivetä; mittakaava, asteikko
plumb /plʌm/ mitata syvyyttä, luodata, syväluodata; suoraan; pystysuora
depth /depθ/ syvyys
manned /mænd/ miehitetty
mission /mɪʃn/ tehtävä, missio
stranded /strændɪd/ hylätty, jätetty
chronicle /ˈkrɒnɪkl/ kronikoida, kertoa
harshness /ˈhɑːʃnəs/ rankkuus, karuus
rugged /rʌgɪd/

---

scenery /siːnəri/ maisema, kulissit
landscape /lændskeɪp/ maisema; maisemoida
appeal /əˈpiːl/ vedota; vetovoima
lunatic /luːnətɪk/

---

barren /bærən/ karu, aavikkoinen, hedelmätön
wasteland /weɪstlænd/ erämaa, joutomaa
pressure /preʃə/ paine; painostaa, ahdistaa
vessel /vesl/

---

atmospheric /ˌætməsˈferɪk/

---

surface /sɜːfɪs/ pinta; nousta pintaan, tulla julki
sturdy /stɜːdi/ roteva, tanakka, jykevä, vankka
container /kənˈteɪnə/ astia, säiliö
oxygen /ɒksɪdʒən/ happi
entirely /ɪnˈtaɪəli/ kokonaan, täysin; kerrassaan
carbon dioxide /kɑːbən daɪˈɒksaɪd/ hiilidioksidi
strip /strɪp/ poistaa; suikale, liuska
liberate /lɪbəreɪt/ vapauttaa
oxygenator /ɒksɪdʒəneɪtə/ hapetin, happilaite
radiation shielding /ˌreɪdɪˈeɪʃn ʃiːldɪŋ/ säteilysuoja
liquid /lɪkwɪd/ nestemäinen; neste
core /kɔː/

---

magnetic field /mægˈnetɪk fiːld/ magneettikenttä

nasty /nɑːsti, næsti/ ilkeä, häijy
puke /pjuːk/ oksentaa; oksennus
radiation /ˌreɪdɪˈeɪʃn/ säteily
cancer /kænsə/ syöpä
bury /beri/ haudata, kätkeä, kaivaa maahan
blocking /blɒkɪŋ/ eristävä
provide /prəˈvaɪd/ varustaa, tarjota, elättää
the Curiosity probe /ðə ˌkjuərɪˈɒsɪti prəub/ Mars-mönkijä, kulkija, luotain, laskeutuja
soil /sɔɪl/ maaperä, maa
cubic meter /kjuːbɪk miːtə/ kuutiometri
scoop /skuːp/ kauhoa, lappaa, ammentaa; kauhallinen, kauha
strain /streɪn/ seuloa, siivilöidä; rasitus, kuormitus
supply /səˈplaɪ/ varasto, tarjonta; hankkia, varustaa
distillery /dɪˈstɪləri/

---

reuse /ˌriːˈjuːz; ˈriːjuːs/ kierrättää; kierrätys
abundance /əˈbʌndəns/

---

decent /diːsnt/ kelpo, ihan hyvä, sopiva
greenhouse /griːnhaus/ kasvihuone
evolve /ɪˈvɒlv/

---

optimize /ɒptɪmaɪz/ tehostaa, optimoida
vacuum /vækjuəm/ tyhjiö, vakuumi; pölynimuri; imuroida
yield /jiːld/ saanti, tuotto; tuottaa, antaa
self-contained /ˌselfkənˈteɪnd/ itsenäinen, omavarainen
continual /kənˈtɪnjuəl/ jatkuva, pysyvä, toistuva
drain /dreɪn/ rasite, vuoto, viemäri; tyhjentyä, kuivua
notably /nəutəbli/ eritoten, varsinkin
biosphere /baɪəsfɪə/ eliökehä, biosfääri
civilization /ˌsɪvɪlaɪˈzeɪʃn/ sivistys, kulttuuri, sivilisaatio
exploit /ɪkˈsplɔɪt; eksplɔɪt/ käyttää hyväkseen, hyödyntää, riistää; urotyö
resource /rɪˈsɔːs/ voimavara, resurssi, keino; resursoida
profit /prɒfɪt/ voitto, tuotto; tuottaa
death ray /deθ reɪ/ kuolemansäde, energia-ase
ominous /ɒmɪnəs/

---

ransom /rænsəm/ lunnaat, lunnasrahat; maksaa lunnaat
define /dɪˈfaɪn/ määritellä, rajata
harsh /hɑːʃ/ ankara, karkea
rescue /reskjuː/ pelastus; pelastaa

1D Answer the following questions in pairs.

1 Why do you need a pressure vessel on Mars?
2 In what ways can you get oxygen on Mars?
3 Why is there more radiation on Mars than on Earth?
4 How can you get water on Mars?
5 How can you grow food on Mars?
6 According to the text, "if something goes wrong you'll have no hope of rescue". Why?

1E The following statements are all false. Find the correct information in the text and change the sentences so that they are in keeping with the text.

1 Mars's atmospheric pressure is less than one percent of the Moon's.
2 There are not many ways to strip the carbon off carbon dioxide and liberate the oxygen.
3 The Earth's solid core gives it a magnetic field that protects us from the sun.
4 To get water on Mars all you need to do is collect the ice and heat it up.
5 Mars's average daily temperature is -30°C (-22°F), so it'll be a continual energy drain to keep warm.

Phrase hunt

1F **Find the following expressions in the text.**

1 Ihmiskunta syntyi _____
2 Mitkä syysi ovatkaan _____
3 vähemmän kuin prosentti _____
4 Sinun on parasta _____
5 Ellet pidä syövästä _____
6 niukka, vähäinen _____
7 samanlainen kuin maan _____
8 Puhumattakaan _____
9 Hyödyntää paikallisia resursseja _____
10 ei ole toivoakaan pelastumisesta _____

1G **Replace the underlined expression with the ones in exercise 1F.**

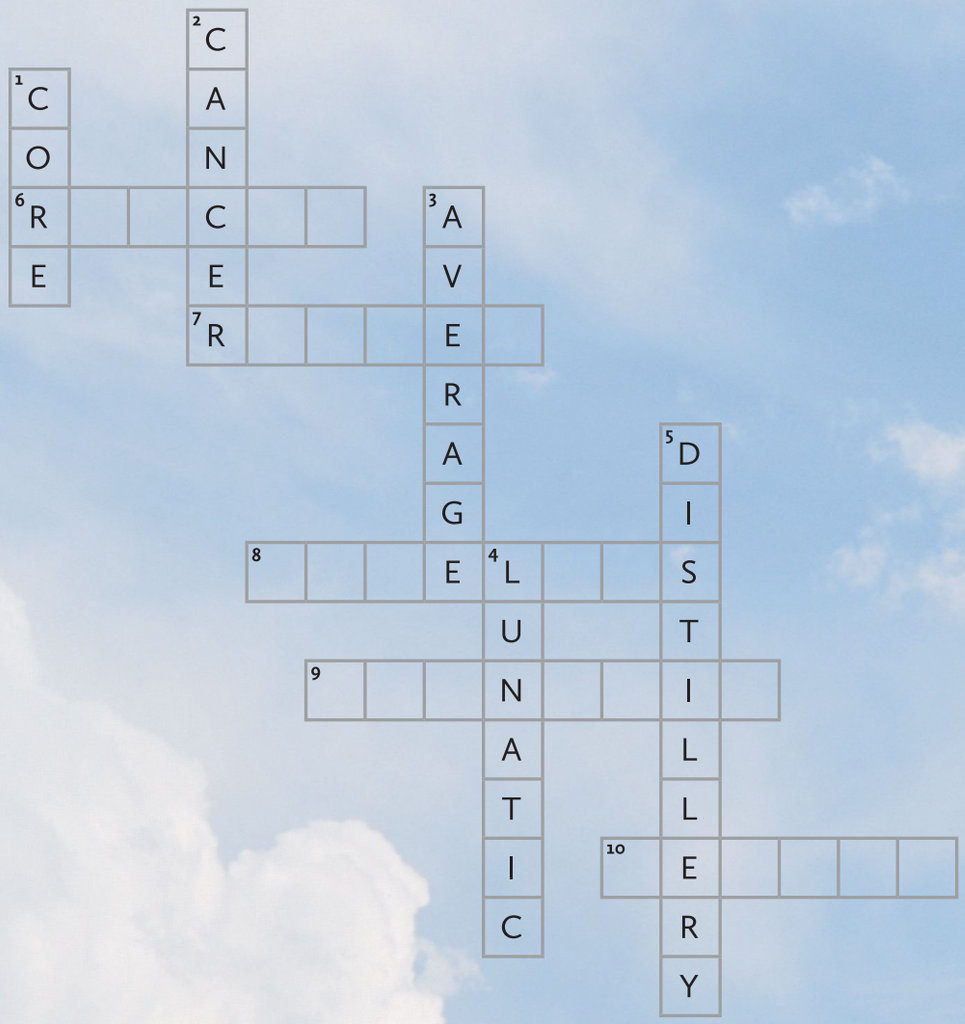
1 Are dust storms on Mars the same as the sandstorms on Earth?
2 Fresh vegetables might be scarce on Mars.
3 If you run into trouble on Mars, nobody will save you.
4 You should have a good reason for going to Mars.
5 If you want to start a business on Mars, you could make use of the area's riches to make money.

1H **In pairs, connect the following sentences and translate them.**

1	You had better bring _____	A	not to mention the risks.
2	The cost of getting to Mars will be high _____	B	if something goes wrong.
3	You'll have no hope of rescue _____	C	but may harm the ecosystem.
4	You can exploit local resources _____	D	you'll need a radiation shield.
5	Unless you're a fan of cancer _____	E	an oxygenator.

1I **Talking crossword. You and your partner both have the same crossword but half of the words are missing in each version. Give each other clues to fill in the missing words.**

Student A: Use the crossword on this page.
Student B: Turn to page 186.



1J Choose the correct alternative.

A warmer world

There is an **1 abundance / appeal** of sunlight falling on our planet. In the space of just one hour, the amount of solar **2 radiation / supply** absorbed by the Earth's surface is enough to satisfy global energy needs for an entire year. For millions of years plants have used this energy source to turn water and **3 carbon dioxide / liquid** into a sugar called glucose, releasing **4 oxygen / pressure** in the process.

Unfortunately, CO_2 levels are rising faster than plants can absorb the gas. The build-up of CO_2 in the atmosphere traps sunlight in the same way a **5 death ray / greenhouse** does, and this is why our planet is getting warmer. Some scientists have made **6 mechanical / ominous** predictions about the future. They argue that this kind of warming will create a **7 harsh / vast** environment in which humans will struggle to survive. Other scientists take a more optimistic view. They say that we humans have **8 evolved / survived** to adapt to such challenges; the ability to cope with a changing world is **9 hardwired / self-contained** into us. They argue that humanity will find innovative ways to **10 define / reuse** the carbon dioxide in the atmosphere, and this will offset the worst effects of climate change.

1K Listen to a radio programme about space travel.

Would you go to Mars?

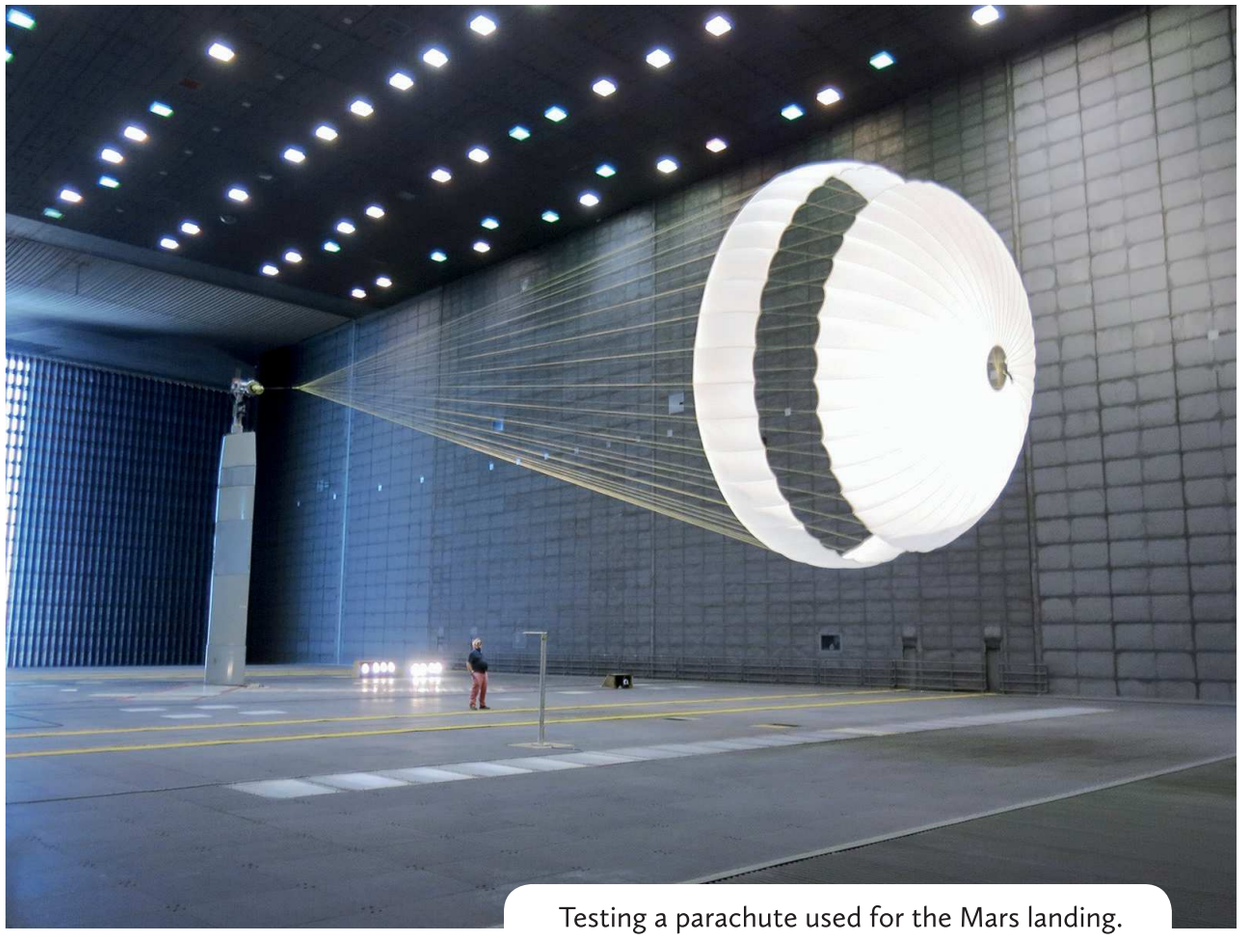
With the Mars One project seeking applicants for a one-way trip to Mars, a local radio station in Manchester asked members of the public if they would be prepared to sign up for the journey.

Before you listen, match the following expressions that appear in the text.

1	Good riddance! _____	A	olla nopea jaloistaan
2	a life sentence _____	B	minua ei haittaisi
3	things get rough _____	C	Tervemenoa!
4	I wouldn't mind _____	D	raapaista pintaa
5	be nippy on one's feet _____	E	mökkihöperyys
6	scratch the surface _____	F	elinkautinen
7	go at the drop of a hat _____	G	kahden viikon päästä
8	in a fortnight _____	H	olot käyvät hankalaksi
9	do someone in _____	I	lähteä välittömästi
10	cabin fever _____	J	tappaa joku

After listening, write down three reasons for going to Mars and three reasons for not going to Mars.

Going to Mars	Not going to Mars



Testing a parachute used for the Mars landing.

1L **Work in pairs or small groups. Go online and collect information on the following subjects. Choose different topics, make notes and present your findings to the group.**

- the exploration of Mars
- the international space station
- the training of an astronaut
- the daily life of an astronaut
- space tourism

1M **Choose task A, B or C. Write about 150–250 words.**

A Are we spending too much money on space exploration? Discuss.
B Life on Mars
C Write a review of a science fiction film or book.

Topic 2

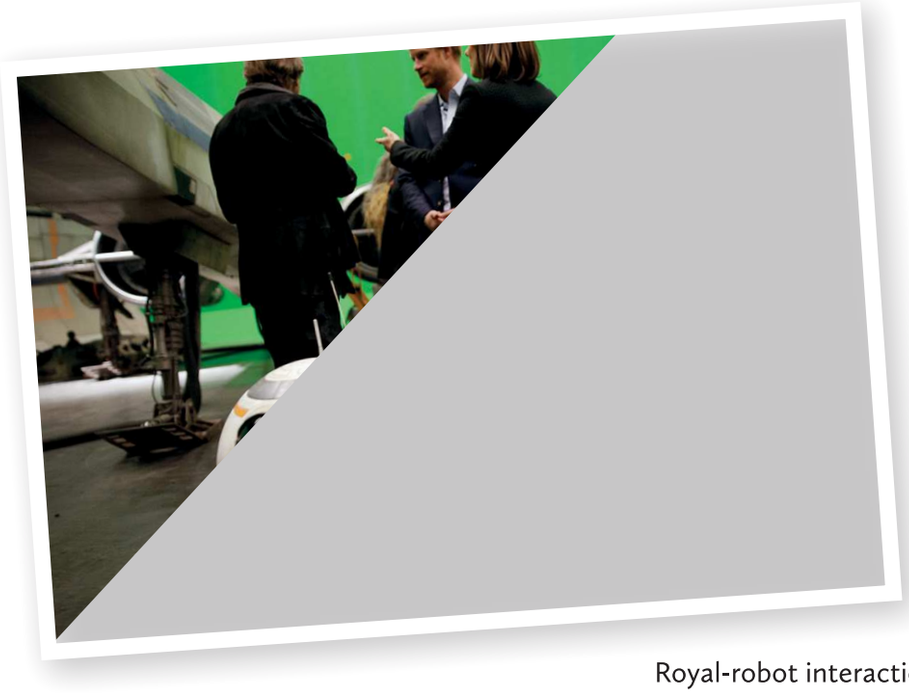
Rise of the robot

As president, I believe that robotics can inspire young people to pursue science and engineering. And I also want to keep an eye on those robots in case they try anything. *(Barack Obama, 44th President of the USA)*

2A Robots Inc. Work in pairs. Imagine that you work for a robotics company. Your job is to design the next generation of domestic robots to be used around and inside homes, as well as for social interaction. Decide on the following points with your partner:

- What are the main functions of the robot?
- What does it look like?
- How does it move?
- How does it communicate?
- How much does it cost?
- What target group is your robot aimed at?
- What is the name for this kind of robot?

Draw your robot and then explain the main features of your robot to another pair.



Royal-robot interaction.

2B Robot language. Match the word with its definition.

1 android _____
2 cobot A
3 cybernetics _____
4 cyborg _____
5 grey goo scenario _____
6 kinematics _____
7 chatbot _____
8 uncanny valley _____

A A robot that is designed specifically to collaborate with humans in the workplace.

B A computer program designed to simulate conversation with human beings, especially over the internet.

C The study of motion when applied to robots.

D A robot that resembles a human being in appearance.

E The concept means that the closer a computer-generated figure or humanoid robot resembles a human being, the more likely it is to cause a sense of unease or repulsion in a person.

F A term used to describe the situation if tiny self-replicating robots get out of control and start to use other life forms as an energy source.

G An organism with both biological and artificial parts.

H The study of control or regulation mechanisms in human and machine systems.

Personal dictionary

2C Read text 2. Find the words below in the text and underline them.

- First, guess the meaning of the words, then look them up in the vocabulary app if necessary and write them down on p. 30.
- Choose 3–5 extra words and mark them, too.
- Try making sentences with some of the words.

1 coin
2 onlooker
3 deliberately
4 clichéd
5 engage in
6 assembly line
7 disposal
8 biopsy
9 reigning
10 milestone

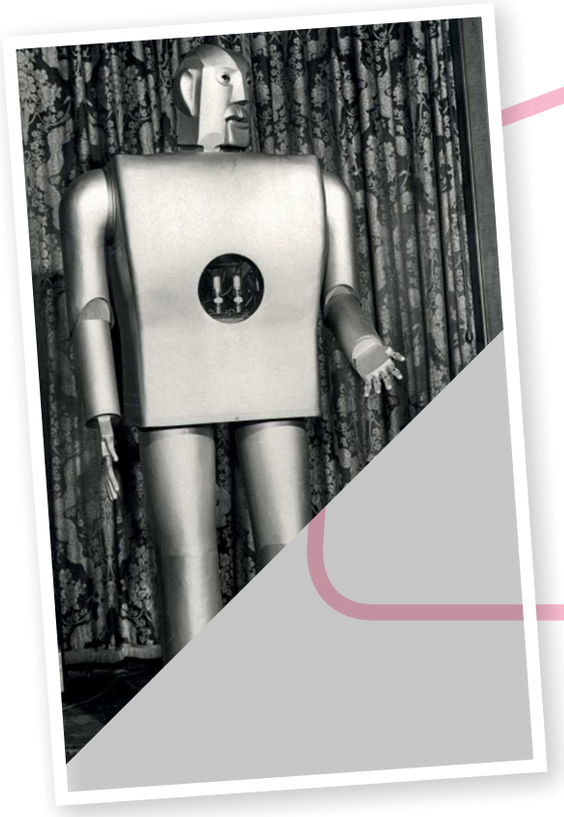
Topic 2 Key text

Rise of the robot: timeline

Robots have come a long way from the tin men who stride stiffly across the sets of early science fiction movies. Here are some of the landmark moments in the development of robots.

1920s

Etymology: The term "robot" was coined by the Czech playwright Karel Čapek to describe the artificially created workers in his 1921 play, R.U.R., or Rossum's Universal Robots.



1930s

Show-bot: Seven-foot tall, with a vocabulary of 700 words, the robot Elektro drew huge crowds at the 1939 World's Fair in New York. "I am a smart fellow as I have a very fine brain," he announced to stunned onlookers. Elektro, who was capable of performing twenty-six movements, ended his performance by smoking a cigarette. His designers deliberately added a hole in his chest, so audiences could clearly see that there was no human operator inside.

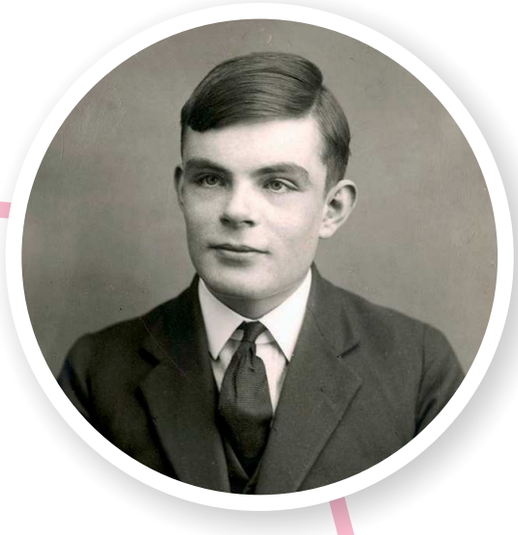
1940s

Robot ethics: Fed up with clichéd stories in which robots continually rise up against their human overlords, the science fiction writer Isaac Asimov wrote a set of rules for avoiding a robopocalypse. The famous "Laws of Robotics" first appear in his 1942 story *Runaround*.

1. A robot may not injure a human, or allow a human to be injured.
2. A robot must follow any order given by a human that doesn't conflict with the First Law.
3. A robot must protect itself unless that would conflict with the First or Second Laws.

1950s

The Turing Test: In his 1950 paper "Computing machinery and intelligence" the mathematician Alan Turing proposed a test to determine whether a machine truly has the power to think for itself. During the "Turing test" a machine will engage in a conversation with a human being. If the person conducting the test cannot determine whether they are talking to a computer or another human being, then the machine has passed the test.



1960s

Industrial robots: The arrival of transistors and integrated circuits opened the door to a generation of more sophisticated robots. Unimate, the first industrial robot, joined the General Motors workforce in 1961. The machine transported heavy die castings from an assembly line and welded them onto car bodies. Since Unimate never called in sick, went on strike or violated company rules, it soon proved a hit with factory owners, and a whole new industry was born.

1970s

Bomb disposal: The original bomb disposal robot, the Wheelbarrow, was invented in 1972 by Colonel Peter Miller. He modified an ordinary electric wheelbarrow to approach booby-trapped cars.

1980s

Robo-surgeon: The first robot to assist in surgery was developed in Canada in 1983. The Arthrobot – or joint robot – was used in hip operations at a Vancouver hospital, and its success led to the rapid development of other robot assistants, including a robotic arm that performed eye surgery, and another for drilling and taking biopsies during brain operations.

1990s

Chess champion: On 11 May 1997 IBM's Deep Blue computer beat the reigning world chess champion Garry Kasparov in just 19 moves. Today's mass-produced chess computers can now defeat even the best human players.

2000s

Driving robots: In 2005, a robot vehicle "Stanley" designed by a team from Stanford University drove across 132 miles of rugged desert terrain without any human help.

2010s

Machines that learn: In 2016, Google's DeepMind program defeated the legendary Go player Lee Se-dol. This came as a surprise because the ancient Chinese game of Go has an astonishing number of possible moves and outcomes – more than the number of atoms in the universe. Therefore, the programme could not simply process all possible moves and choose the best one; it had to learn how to play, and of course, learn from its mistakes. This is why the victory was hailed as a key milestone on the road to artificial intelligence.

2050s

Robots in the future?
Will robots take over all human jobs in the following decades? Will artificial intelligence become superior to human intelligence?

Write your own prediction for the 2050s in one paragraph.

***come a long way** /kʌm ə lɒŋ weɪ/ päästä pitkälle, edistyä
tin man /tɪn mæn/ tinamies
stride /straɪd/ harppoa, kävellä pitkin askelin, astella
stiffly /stɪfli/ kankeasti
landmark /lændmɑːk/ virstanpylväs
etymology /ˌetɪˈmɒlədʒi/ etymologia, sanan alkuperä
coin /kɔɪn/

Czech /tʃek/ tšekkiläinen, tšekin kieli
artificially /ˌɑːtɪˈfɪʃəli/ keinotekoisesti
announce /əˈnauns/ julistaa, kuuluttaa, tiedottaa
stunned /stʌnd/ hölmistynyt, pökertynyt
onlooker /ɒnlukə/

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capable of /keɪpəbl əv/ kykenevä, pystyvä
deliberately /dɪˈlɪbrətli/

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chest /tʃest/ rintakehä
operator /ɒpəreɪtə/ koneenkäyttäjä, toimija
fed up with /fed ʌp wɪð/ kyllästynyt, tympääntynyt
clichéd /kliːʃeɪd; klɪˈʃeɪd/

***rise up against** /raɪz ʌp əˈgenst/ nousta jotakin vastaan
overlord /əuvəlɔːd/ herra, hallitsija, lääninherra
robopocalypse /rəuˈbɒpɔkəlɪps/ robottien aiheuttama maailmanloppu
injure /ɪndʒə/ vahingoittaa, haavoittaa, loukata
allow /əˈlau/ sallia
conflict with /kɒnflɪkt wɪð/ olla ristiriidassa jonkin kanssa
paper /peɪpə/ tieteellinen julkaisu, tutkielma, raportti, paperi
computing /kəmˈpjuːtɪŋ/ tietojenkäsittely
intelligence /ɪnˈtelɪdʒəns/ älykkyys
mathematician /ˌmæθəməˈtɪʃn/ matemaatikko
propose /prəˈpəuz/ ehdottaa, esittää, kosia
determine /dɪˈtɜːmɪn/ ottaa selville, määritellä, arvioida
***think for oneself** /θɪŋk fə wʌnˈself/ ajatella itse
engage in /ɪnˈgeɪdʒ ɪn/

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conduct /kənˈdʌkt, kɒndʌkt/ suorittaa, tehdä, johtaa; johto, käytös, menettely
integrated /ɪntɪgreɪtɪd/ integroitu
circuit /sɜːkɪt/ virtapiiri, piiri, kierros
sophisticated /səˈfɪstɪkeɪtɪd/ monimutkainen, pitkälle kehittynyt, hienostunut, sivistynyt
workforce /wɜːkfɔːs/ työvoima, työntekijät
die casting /daɪ kɑːstɪŋ, kæstɪŋ/ valukappale
assembly line /əˈsembli lain/

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weld /weld/ hitsata
car body /kɑː bɒdi/ auton kori
call in sick /kɔːl ɪn sɪk/ ilmoittautua sairaaksi
***go on strike** /gəu ɒn straɪk/ mennä lakkoon
violate /vaɪəleɪt/ rikkoa, loukata, häiritä
prove /pruːv/ todistaa, näyttää toteen, osoittautua joksikin, koetella
disposal /dɪˈspəuzl/

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wheelbarrow /wiːlbærəu/ kottikärryt
modify /mɒdɪfaɪ/ muuttaa, muokata
approach /əˈprəutʃ/ lähestyä, ehdottaa jotakin; lähestymistapa, lähestyminen, asenne
booby-trapped /buːbitræpt/ ansoitettu
surgery /sɜːdʒəri/ leikkaus, kirurgia
hip operation /hɪp ˌɒpəˈreɪʃn/ lonkkaleikkaus
drilling /drɪlɪŋ/ poraus
biopsy /baɪɒpsi/

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reigning /reɪnɪŋ/

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defeat /dɪˈfiːt/ voittaa, lyödä; tappio, häviö
vehicle /viːɪkl/ ajoneuvo, kulkuväline
terrain /təˈreɪn/ maasto
ancient /eɪnʃnt/ muinainen, ikivanha
astonishing /əˈstɒnɪʃɪŋ/ hämmästyttävä
outcome /autkʌm/ lopputulos
hail /heɪl/ ylistää, tervehtiä; rae, raekuuro
milestone /maɪlstəun/

---

artificial intelligence /ˌɑːtɪˈfɪʃl ɪnˈtelɪdʒns/ tekoäly

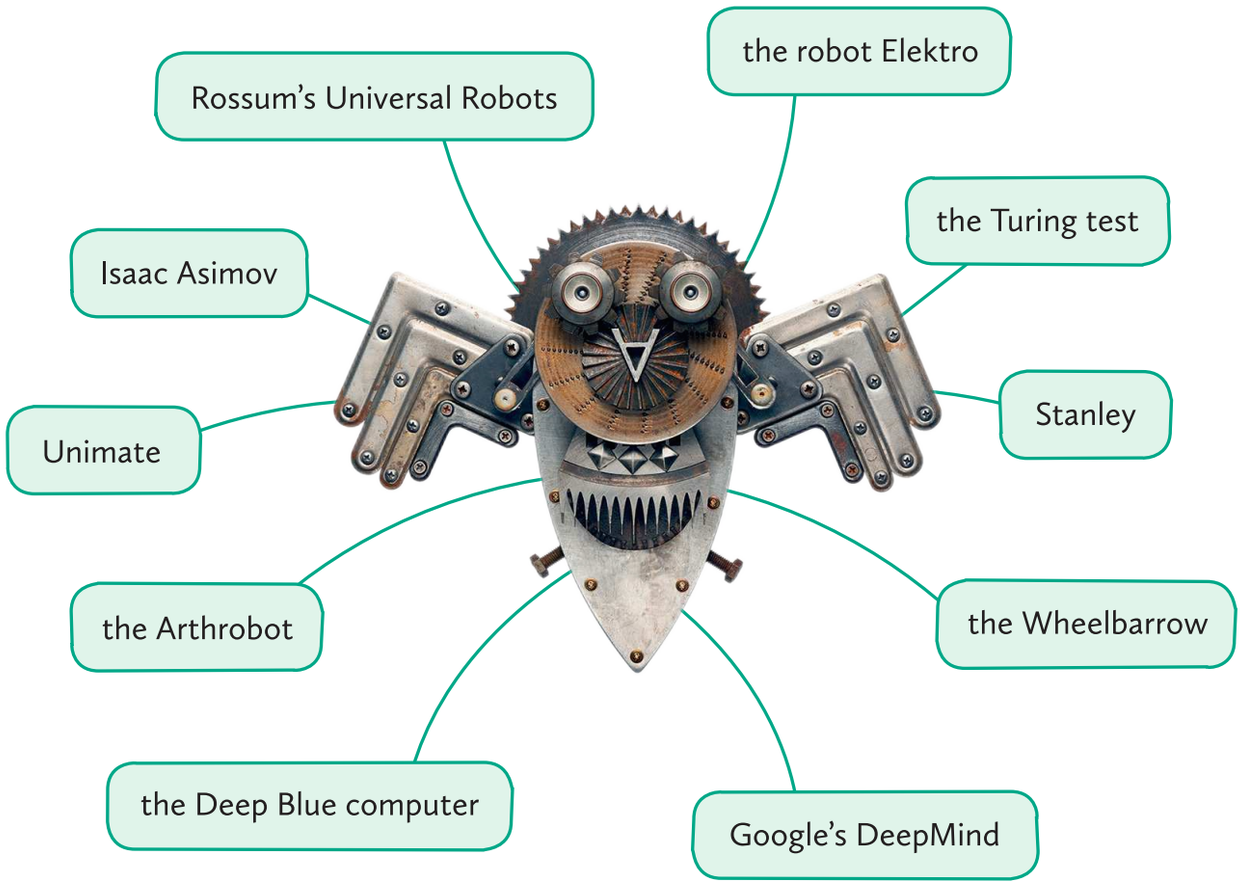
2D **Match the right decade with a landmark moment in the field of robotics. The first one has been done for you. Note that there are two extra pieces of information that do not appear in the text.**

1920s K
1930s _____
1940s _____
1950s _____
1960s _____
1970s _____
1980s _____
1990s _____
2000s _____
2010s _____

A Domestic robots that help with household chores start to appear in stores.
B A computer defeats a professional player for the first time.
C A remotely operated robot is designed to disable explosives.
D A talking robot goes on display at a public exhibition.
E Driverless cars begin to appear.
F Robots are used to manufacture vehicles.
G A researcher tries to find a way to test whether machines can think.
H A robot is featured in a film for the first time.
I An author invents principles for robot behaviour.
J The application of robots in medicine begins.
K The word robot is used for the first time.
L A computer program that learns from experience wins a tournament.

A helping hand.

2E Work in pairs. Decide who is A and who is B. A begins. Take turns choosing at least three topics from the following mind map and explain what was said about them in the text.



Phrase hunt

2F Find the following expressions in the text.

1 ovat edistyneet _____
2 oli kykenevä tekemään _____
3 nousevat jtak vastaan _____
4 olla ristiriidassa jkn kanssa _____
5 joka tekee testin _____
6 ei koskaan mennyt lakkoon _____
7 sen menestys johti _____
8 matkalla kohti tekoälyä _____

2G Fill in the gaps with the help of the Finnish clues. All the expressions are from exercise 2F.

Dental robots

The way dentists are trained **1** _____ (on edistynyt) from drilling old teeth taken from dead people. Trainee dentists in Japan can now **2** _____ (tehdä) a dental examination or perform oral surgery on a robot patient. Showa Hanako is an automaton **3** _____ (kykenevä tekemään) a range of actions including blinking, groaning, gagging, and closing her mouth when tired. "We're **4** _____ (matkalla kohti) creating a truly realistic experience for our students," said Professor Maki from Showa University. The success of the android **5** _____ (on johtanut) a flood of orders from universities all over the world.

Now we have robot patients, how about robot dentists? This is still some way off. Many people won't accept a machine performing this intimate work, and unions **6** _____ (ovat myös nousseet vastaan) the idea. They argue that it will put dentists out of work. Such machines can work 24/7 and, of course, they **7** _____ (eivät koskaan mene lakkoon). On the other hand, as long as the treatment offered by these robots **8** _____ (ei ole ristiriidassa) professional standards of patient care, it is likely that sooner or later we will be booking an appointment with a robot dentist.

2H Match the verbs that have a similar meaning in text 2. Then translate them into Finnish.

1	create _____	A	transport _____
2	suggest _____	B	conduct _____
3	participate in _____	C	propose _____
4	praise _____	D	coin _____
5	beat _____	E	stride _____
6	aid _____	F	hail _____
7	move _____	G	engage in _____
8	march _____	H	modify _____
9	carry out _____	I	defeat _____
10	change _____	J	assist _____

2I Choose the correct preposition for each sentence.

When IBM first released its data-processing equipment in the sixties, it came **1 with / as** a surprise to the company that its own customers were unenthusiastic about buying the new machines. "If these machines are really as clever as advertised, wouldn't they threaten our jobs?" people asked. "Wouldn't it lead **2 to / on** massive unemployment?" To avoid **3 of / –** alarming their customers, the advertising department at IBM proposed **4 – / to** the following phrase: "Computers can only do what they are programmed to do."

Well, not any more. For some time now, computers have been able to learn **5 – / from** their mistakes and think **6 as / for** themselves. And so, of course, can modern robots. The latest robots can see in three dimensions, and are already being used **7 – / in** the fast food industry to cook and serve meals. Since they never **8 call in / call –** sick or argue with customers, employers may be understandably keen to employ robots instead of inconvenient humans. Perhaps those early IBM customers were right to be worried about the future of their jobs?

2J **Work in pairs or small groups. Discuss the following questions in English.**

1 If you had a home robot, what would you like it to do?
2 What robots or artificial intelligence systems can you name from films, television, books or video games?
3 What are the abilities of these robots?
4 Do you think robots like these will ever exist?
5 Which jobs can a robot do better than a human?
6 Many films and novels suggest that we should fear robots. Do you think they're right?

INFO BOX

High or tall?

It is not always easy to know which of these two adjectives to use. The following hints might help you.

High describes a distance above the ground.
e.g. Saana is not a high mountain, but the view from the top is amazing.
The shelf where the chemicals were stored was too high for the students to reach.

Tall describes people or things that are thin in shape such as trees or buildings.
e.g. The Serbian scientist Nikola Tesla was over six feet tall.
The trees at our summer place are so tall we don't get much light.

Note:
Long describes a horizontal dimension.
e.g. The viper we found in the backyard was 80 cm long.
My sister is 180 cm ~~long~~ tall.

2K The following role plays involve different types of robots.

- In pairs, decide which one of you is A and B.
- Start the conversation using the opening line. Can you keep the conversation going for two full minutes?
- After two minutes, stop the role play and move on to the next one.

Role plays

Domestic robot

A: You bought a robot from a store a week ago. It was supposed to help around the home. Instead it has caused a lot of problems. Now have asked to see the manager. Tell them what you are unhappy about.

B: You are the manager of a high-tech store selling robots to help around the home. A customer has come to complain about a robot you sold them. You think the robots are wonderful. You blame the customer for the problem.

Opening line
A: I'd like to talk about one of your products.

Chatbot

A: You are spending more and more of your time talking to a chatbot online. You think it is good company – it's never in a bad mood, it never complains, and it never criticises you. Try explaining to your friend why you prefer spending time with the chatbot rather than with them.

B: You are friends with someone who spends hours online talking to a chatbot. You are worried about them. Persuade them to come out bowling with you and a group of friends.

Opening line
B: It's Friday. Are you joining us this evening?

Factory robot

A: You are a factory boss who is going to replace many workers with robots. You have called a meeting with the union representative to explain the new situation. Try to put things as positively as possible.

B: You are a union representative. Your job is to fight for the rights of the workers in a big factory. The boss of that factory has called you into their office to discuss something with you. You hope it is the pay rise you have been asking for.

Opening line
A: Good morning. Glad you could make it.

Artificial intelligence

A: You are a team leader of a project to develop artificial intelligence. One of your research assistants has asked to see you. Ask them what exactly is worrying them.

B: You are a research assistant who is worried about the AI project you are working on. You think the AI you have created is developing too fast. It already knows the names and personal information of every member of the research team. It even knows embarrassing details about your boss's life. You have asked to see your boss to explain your worries. You think the project should be terminated.

Opening line
B: I know you're busy. Thanks for finding the time to see me.

2L **Living with robots. The concept of a human-robot society, just beginning to take root in some countries, is already thriving in Japan. Listen to the following examples of human-robot interaction in the Land of the Rising Sun and answer the questions in Finnish.**

1 Mitä eroa on japanilaisten ja länsimaisten ihmisten suhtautumisessa robotteihin?
2 Millaisia robotteja on käytössä vanhainkodeissa Kanagawassa? Mainitse kaksi.
3 Millaisia uusia palveluja robottikoirien omistajille on tarjolla?
4 Miltä Pepper näyttää ja miten se liikkuu?
5 Mikä on Pepperin tehtävä? Mainitse kaksi asiaa.

More than just a toy.

2M **Choose task A or B. Write about 150–250 words.**

A I, Robot
Imagine you are a robot. Describe your daily routines and feelings about your owner.

B Robots – a threat or an opportunity?
Some people think robots will have a positive effect on society, while others claim robots will do society more harm than good.
Discuss both views and give your opinion.

2N **Mini-research paper. First do some research and then write a short report on one of following topics. See the online *How to write* section for help.**

- Domestic robots
- Drones
- Industrial robots
- Making robots as a hobby
- Medical robots
- Military robots
- Space robots
- Therapeutic robots

Topic 3

Science and technology

3A **All the vocabulary in the box below is related to science. Read through the words and fill in the gaps with the help of the Finnish clues.**

have advanced	bacteria
breakthroughs	calculate
discovered	discoveries
elements	experiments
empirical	gadgets
gravity	invention
orbit	organisms
particles	research
scientific	scientists
species	transformers
vaccines	X-ray

Scientists who changed the world

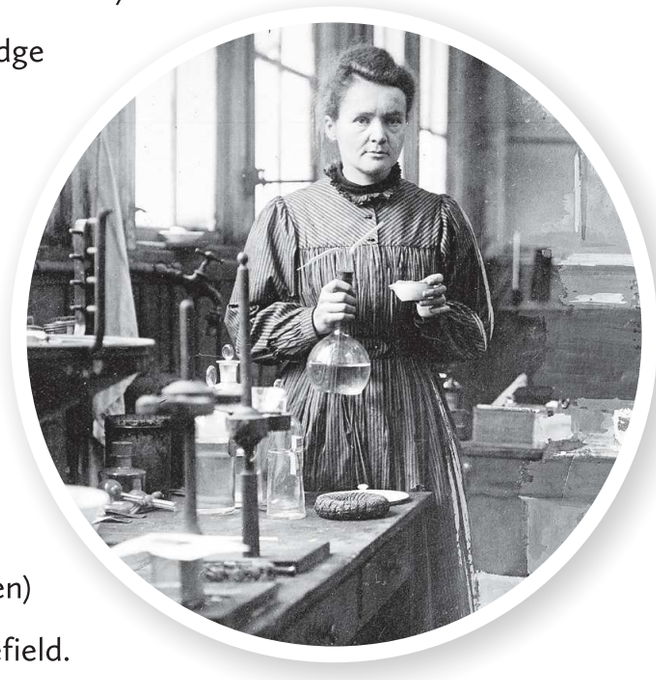
The world we live in is shaped by the scientific **1** _____ (löydöt) of the past. Here are six **2** _____ (tutkijat, tieteenharjoittajat) who have transformed our understanding of the world we live in.

Isaac Newton (1643–1727): It was Newton's theory of **3** _____ (painovoima) that first explained why planets **4** _____ (kiertävät) the sun. In addition, his **5** _____ (tutkimus) into optics led to the **6** _____ (keksintö) of the reflecting telescope used by astronomers today.

Michael Faraday (1791–1895): Faraday's **7** _____ (kokeet) with electricity facilitated the army of **8** _____ (laitteet) and devices that dominate modern life. His understanding of electromagnetic induction gave rise to electric motors, **9** _____ (muuntajat) and generators.

Charles Darwin (1809–1882): Darwin's careful, **10** _____ (kokemusperäinen) observation of nature gave rise to his theory of evolution. He observed that all **11** _____ (eliöt) evolve, or change, very slowly over time, and those best suited to their surroundings are the ones that survive. Simple, but it explains the variety of **12** _____ (lajit) on our planet.

Louis Pasteur (1822–1895): Pasteur's study of microbes revealed that infectious diseases are caused by microorganisms. He also **13** _____ (keksi, huomasi) that **14** _____ (bakteerit) could be killed by heat and disinfectant – knowledge that led to the development of life-saving **15** _____ (rokotteet).



Marie Curie (1867–1934): Curie is famous for her pioneering work with radioactivity, a word she invented. She discovered two radioactive **16** _____ (alkuaineet), polonium and radium, and created the first mobile **17** _____ (röntgen) machine to examine injured soldiers on the battlefield.

Albert Einstein (1879–1955): Einstein's **18** _____ (läpimurrot) in theoretical physics led to a new understanding of space and time, and also a way to **19** _____ (laskea) the amount of energy released from splitting an atom. In addition, he proposed the idea that light exists as **20** _____ (hiukkaset), which he called photons.

Although all these scientists **21** _____ (ovat edistäneet) human knowledge, it is worth remembering that **22** _____ (tieteellinen) progress is largely a collaborative process. As Newton modestly put it: "If I have seen further, it is by standing on the shoulders of giants."

3B Let's talk chemistry. In pairs, decide which one of you is A and B. Cover the other half. Take turns translating the sentences into English. Your partner will check your answers.

	A	B
1	**Carbon monoxide is a colourless, odourless, toxic gas.**	Häkä (hiilimonoksidi) on väritön, hajuton, myrkyllinen kaasu.
2	Hiilidioksidi on haitallinen kasvihuone-kaasu.	**Carbon dioxide is a harmful greenhouse gas.**
3	**A water molecule contains one oxygen and two hydrogen atoms.**	Vesimolekyyli sisältää yhden happi- ja kaksi vetyatomia.
4	Vesi voi esiintyä kolmessa olomuodossa: kiinteänä (jää), nesteenä (vesi) tai kaasuna (vesihöyry).	**Water can occur in three forms: solid (ice), liquid (water), or gas (water vapour).**
5	**Nitrogen is a common element on Earth. It forms about 78% of Earth's atmosphere.**	Typpi on yleinen alkuaine maapallolla. Se muodostaa noin 78% maan ilma-kehästä.
6	Mikä on kemiallisen yhdisteen natrium-kloridin tavallinen nimi?	**What is the common name for the chemical compound sodium chloride?**
7	**Sulphuric acid is a highly corrosive, water-soluble acid.**	Rikkihappo on erittäin syövyttävä, veteen liukeneva happo.
8	Elohopea on raskas metallinen alkuaine jota käytetään kuumemittareissa ja loisteputkissa.	**Mercury is a heavy metallic element that is used in thermometers and fluorescent lamps.**

3C **Tech talk. Read the following short scenes with your partner. Use the Finnish clues to help you fill in the gaps. Afterwards, listen to the audio to check your answers. What do you think is happening in each situation?**

Situation 1

Jim: What's the **1** _____ (salasana)? I haven't used this **2** _____ (tili) for ages. Oh, I remember. There, I've **3** _____ (kirjautunut sisään).

Jill: You can't **4** _____ (ladata) that for everyone to see. Dad'll go mad.

Jim: It's my video. Anyway, it's hilarious. Right, I've filled out the title. What key words are we going to use as **5** _____ (tunnisteet)? Dad, skateboard, disaster. Yeah?

Jill: He won't want the whole world seeing this.

Jim: Depends on what **6** _____ (tietosuoja- tai yksityisyysasetukset) we choose, doesn't it? Now let's pick a **7** _____ (esikatselukuva). What do you think?

What is happening? _____

Situation 2

IT administrator: Listen up. Here are a few things we'd like our new employees to keep in mind. There is an advanced **8** _____ (palomuuri) in place to block unauthorised **9** _____ (pääsy), so we don't get much trouble from **10** _____ (hakkerit). And all data is **11** _____ (salattu) as a matter of course. But none of that matters is you don't play your part. Don't open suspicious emails. **12** _____ (Verkkourkinta) emails contain links to websites that are infected with **13** _____ (haittaohjelmat) such as viruses or **14** _____ (vakoiluohjelmat). And then we've had **15** _____ (nettihuijarit) sending us official-looking emails that offer to test password strength. Never give out your password. Not even to me.

What is happening? _____ →

Situation 3

Karl: It's easy Grandma, just **16** _____ (näpäytä) the messages **17** _____ (kuvake).

Grandma: The speech bubble?

Karl: Yes. Now you've opened your messages, see? You've been texting Enid.

Grandma: Yes, she wants to see the puppy.

Karl: OK. See the tiny camera **18** _____ (painike) in the bottom left-hand corner?

Grandma: I press this?

Karl: Yes, now the **19** _____ (valikko) has come up. You've three options. Tap "Choose existing".

Grandma: What's a **20** _____ (kameran kuvat)?

Karl: It's your photo album. Hit that. Now, **21** _____ (vieritä, selaa) through your pictures.

Grandma: Hmm. I want that one. Isn't she beautiful?

Karl: She is. OK, tap "Choose". There, it's popped up like a normal message. Now hit send.

Grandma: What's that line at the top?

Karl: That's the **22** _____ (edistymispalkki). It's going through. There, now you've sent it.

What is happening? _____

I heard oxygen and magnesium were going out. And I was like OMG.

Once, I told a chemistry joke. There was no reaction.

Topic 4

Read on

The history of civilisation is largely the history of weapons.
(George Orwell, English novelist and journalist)

4A **Mini drama. With your partner, plan a short dialogue or story in which you have three characters and two items. Remember that a good story needs a strong beginning, a middle section that develops the story and a satisfying ending. For more help with writing a dialogue see the online *How to write* section.**

Characters:	Dr James Graham, Harry (his son), Mr Niemand
Items:	a children's book, a revolver
Setting:	home

4B **Work in pairs or small groups. Read the following statements about science and ethics and discuss whether you agree or disagree.**

Science and morality

	Agree	Disagree
All scientific discoveries are morally neutral. They can as easily be used for bad purposes as for good ones.		
Scientists are driven by curiosity. If they are working on something they know will have dangerous consequences, they will continue to work on it anyway.		
If humans are ever wiped off the face of the Earth, it will be science that is to blame.		
No scientific research should ever be funded by the military or by business.		
All science courses should include a unit on ethics.		
The business of science is science, scientists should leave ethical concerns to the politicians.		

Topic 4

Science and ethics

The Weapon

The room was quiet in the dimness of early evening. Dr. James Graham, key scientist of a very important project, sat in his favorite chair, thinking. It was so still that he could hear the turning of pages in the next room as his son leafed through a picture book.

• • •

The doorbell rang.

Graham rose and turned on lights in the almost-dark room before he went through the hallway to the door.

• • •

A stranger stood there; he said, "Dr. Graham? My name is Niemand; I'd like to talk to you. May I come in a moment?"

Graham looked at him. He was a small man, nondescript, obviously harmless – possibly a reporter or an insurance agent.

Graham found himself saying, "Of course. Come in, Mr. Niemand." A few minutes of conversation might divert his thoughts and clear his mind.

"Sit down," he said, in the living room. "Care for a drink?"

Niemand said, "No, thank you." He sat in the chair; Graham sat on the sofa.

The small man interlocked his fingers; he leaned forward. He said, "Dr. Graham, you are the man whose scientific work is more likely than that of any other man to end the human race's chance for survival."

A crackpot, Graham thought. Too late now he realized that he should have asked the man's business before admitting him. It would be an embarrassing interview – he disliked being rude, yet only rudeness was effective.

"Dr. Graham, the weapon on which you are working – "

The visitor stopped and turned his head as the door that led to a bedroom opened and a boy of fifteen came in. The boy didn't notice Niemand; he ran to Graham.

"Daddy, will you read to me now?" The boy of fifteen laughed the sweet laughter of a child of four.

Graham put an arm around the boy. He looked at his visitor, wondering whether he had known about the boy. From the lack of surprise on Niemand's face, Graham felt sure he had known.

"Harry,"– Graham's voice was warm with affection – "Daddy's busy. Just for a little while. Go back to your room; I'll come and read to you soon."

"Chicken Little? You'll read me Chicken Little?"

"If you wish. Now run along. Wait. Harry, this is Mr. Niemand."

The boy smiled bashfully at the visitor. Niemand said, "Hi, Harry," and smiled back at him, holding out his hand. Graham, watching, was sure now that Niemand had known: the smile and the gesture were for the boy's mental age, not his physical one.

The boy took Niemand's hand. For a moment it seemed that he was going to climb into Niemand's lap, and Graham pulled him back gently. He said, "Go to your room now, Harry."

The boy skipped back into his bedroom, not closing the door.

Niemand's eyes met Graham's and he said, "I like him," with obvious sincerity. He added, "I hope that what you're going to read to him will always be true."

Graham didn't understand. Niemand said, "Chicken Little, I mean. It's a fine story – but may Chicken Little always be wrong about the sky falling down."

Graham had liked Niemand when he had shown liking for the boy. Now he remembered that he must close the interview quickly. He rose, in dismissal.

He said, "I fear you're wasting your time and mine, Mr. Niemand. I know all the arguments, everything you can say I've heard a thousand times. Possibly there is truth in what you believe, but it does not concern me. I'm a scientist, and only a scientist. Yes, it is public knowledge that I am working on a weapon, a rather ultimate one. But, for me personally, that is only a by-product of the fact that I am advancing science. I have thought it through, and I have found that that is my only concern."

"But, Dr. Graham, is humanity ready for an ultimate weapon?"

Graham frowned. "I have told you my point of view, Mr. Niemand."

Niemand rose slowly from the chair. He said, "Very well, if you do not choose to discuss it, I'll say no more. I wonder, though... may I change my mind about the drink you offered me?"

Graham's irritation faded. He said, "Certainly. Will whisky and water do?"

"Admirably."

Graham excused himself and went into the kitchen. He got the decanter of whisky, another of water, ice cubes, glasses.

When he returned to the living room, Niemand was just leaving the boy's bedroom. He heard Niemand's "Good night, Harry," and Harry's happy "'Night, Mr. Niemand."

Graham made drinks. A little later, Niemand declined a second one and started to leave.

Niemand said, "I took the liberty of bringing a small gift to your son, doctor. I gave it to him while you were getting the drinks for us. I hope you'll forgive me."

"Of course. Thank you. Good night."

Graham closed the door; he walked through the living room into Harry's room. He said, "All right, Harry. Now I'll read to – "

There was sudden sweat on his forehead, but he forced his face and his voice to be calm as he stepped to the side of the bed. "May I see that, Harry?" When he had it safely, his hands shook as he examined it.

He thought, only a madman would give a loaded revolver to an idiot.

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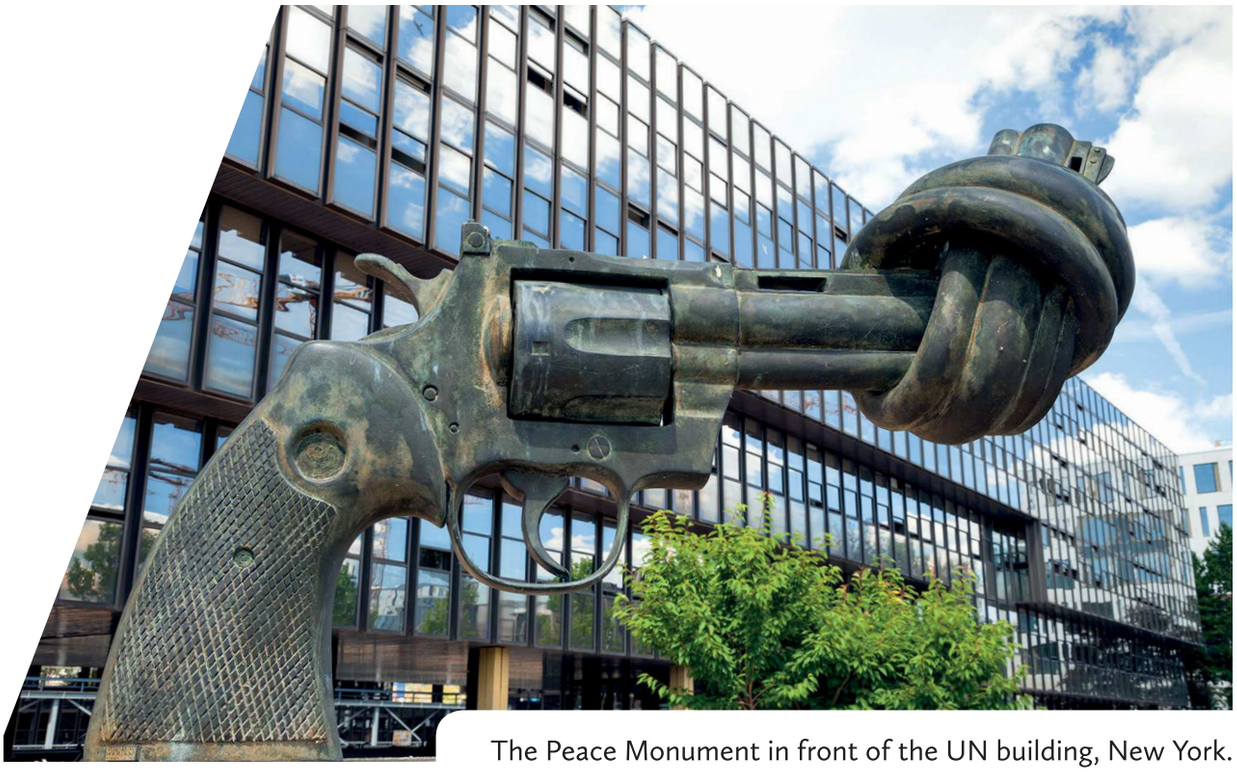
Chicken Little is a children's story about a little chicken. An acorn falls on his head and he worries that the sky is falling.

dimness /dɪmnɪs/ hämäryys
scientist /saɪəntɪst/ tiedemies
leaf through /liːf θruː/ selailla
hallway /hɔːlweɪ/ eteinen
nondescript /nɒndɪskrɪpt/ tylsä, ikävä, mitäänsanomaton, epämääräinen
insurance agent /ɪnˈʃuərəns eɪdʒənt/ vakuutusasiamies
divert /daɪˈvɜːt/ kääntää muualle, viihdyttää
interlock /ˌɪntəˈlɒk/ liittää toisiinsa
lean /liːn/ nojata, kallistua; hoikka, niukka
scientific /ˌsaɪənˈtɪfɪk/ tieteellinen
human race /hjuːmən reɪs/ ihmisrotu
crackpot /krækpɒt/ hullu, höperö
admit /ədˈmɪt/ päästää sisään, ottaa vastaan, hyväksyä
embarrassing /ɪmˈbærəsɪŋ/ kiusallinen, vaivaannuttava, nolo
rudeness /ruːdnɪs/ töykeys, epäkohteliaisuus
affection /əˈfekʃn/ kiintymys, hellyys, rakkaus
bashfully /bæʃfuli/ ujosti, arasti
gesture /dʒestʃə/ ele, (käden) liike
mental age /mentl eidʒ/ henkinen ikä
gently /dʒentli/ hellävaroen, kevyesti
skip /skɪp/ hypellä, pomppia
obvious /ɒbvɪəs/ ilmeinen, silmiinpistävä
sincerity /sɪnˈseriti/ vilpittömyys, rehellisyys
dismissal /dɪsˈmɪsl/ karkottaminen, erottaminen
concern /kənˈsɜːn/ olla tekemistä jnk kanssa, koskea, huolestuttaa; huolenaihe
ultimate /ʌltɪmɪt/ lopullinen, äärimmäinen, ylivertainen
by-product /baiprɒdʌkt/ sivutuote
advance /ədˈvɑːns, ədˈvæns/ edistää, kehittää; ennakko, edistysaskel
humanity /hjuˈmænɪti/ ihmiskunta, ihmisyys
frown /fraun/ rypistää otsaansa, kurtistaa kulmiaan, paheksua
irritation /ˌɪrɪˈteɪʃn/ ärtymys, suuttumus
fade /feɪd/ häipyä, lakata, kuihtua, haalistua
admirably /ædmərəbli/ mainiosti, erinomaisesti
decanter /dɪˈkæntə/ karahvi
decline /dɪˈklaɪn/ kieltäytyä, heiketä, pudota
***take the liberty of** /teɪk ðə lɪbəti əv/ ottaa vapaus
sweat /swet/ hiki; hiota, raataa
forehead /fɒrɪd, fɔːhed/ otsa
force /fɔːs/ pakottaa, pinnistää; voima
examine /ɪgˈzæmɪn/ tutkia, tarkastella, kuulustella
loaded /ləudɪd/ ladattu

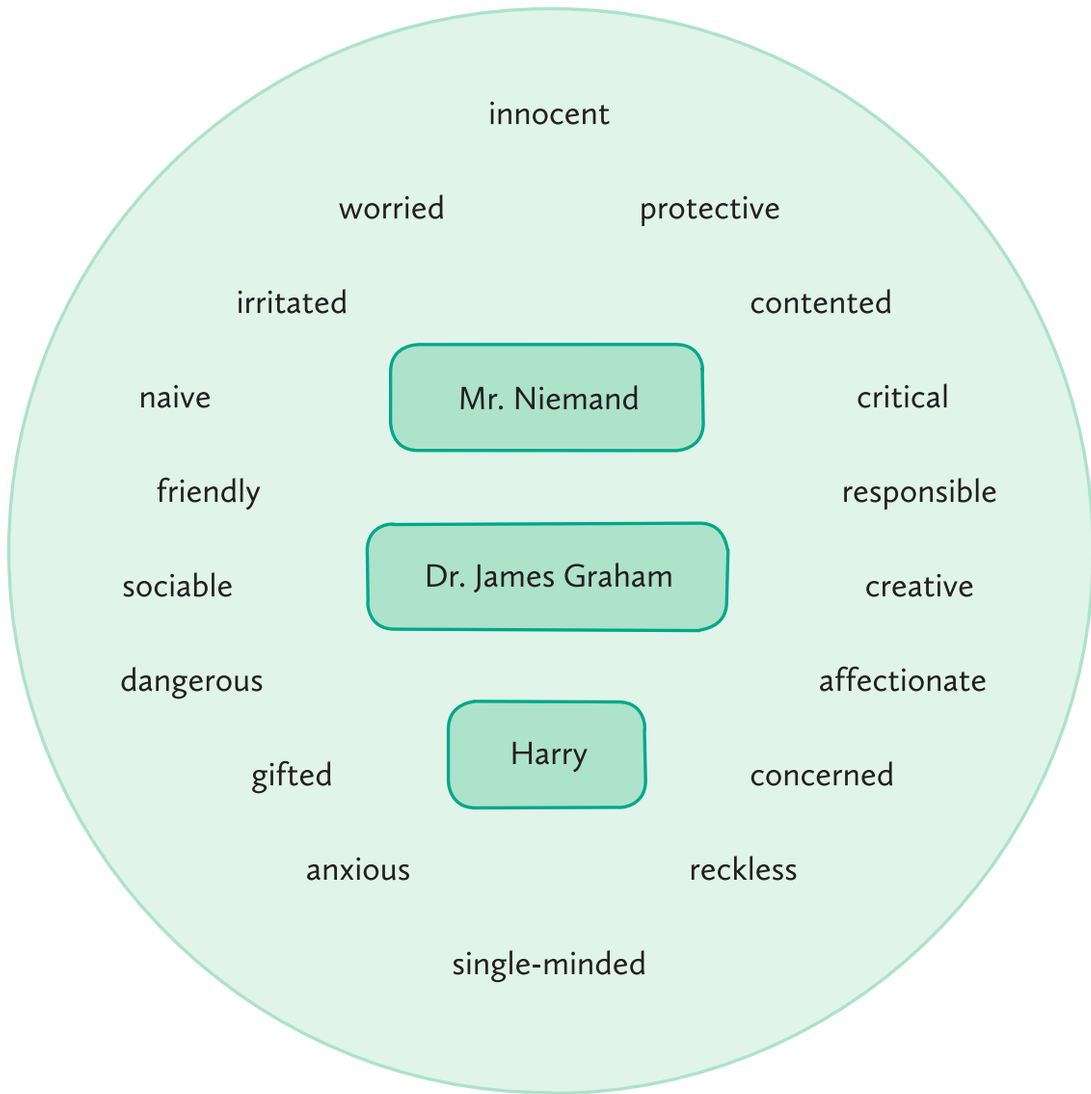


The Peace Monument in front of the UN building, New York.

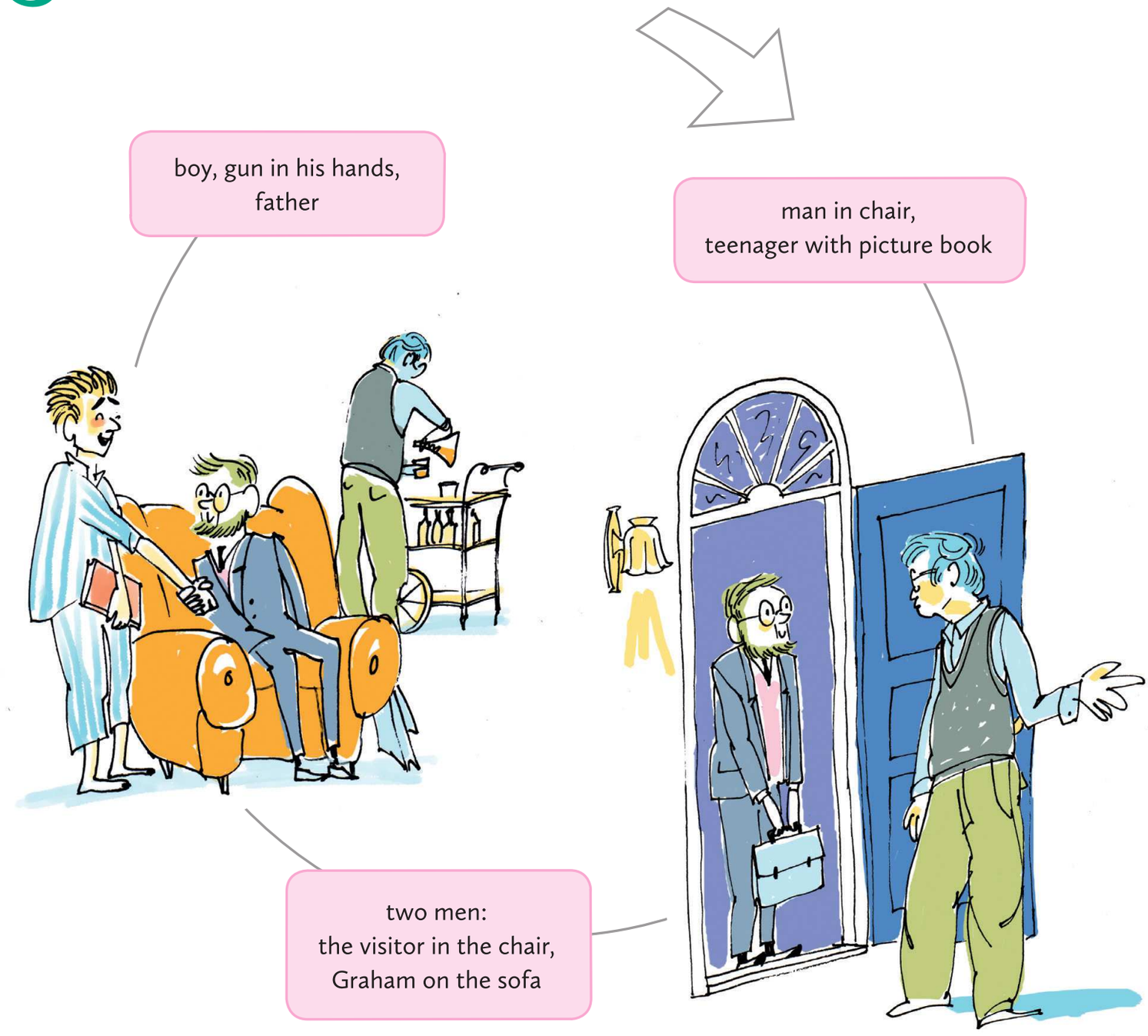
4C Answer the questions in English.

1 What is the atmosphere like at the beginning of the story?
2 Why has the visitor come to see Dr. James Graham?
3 Why does Dr. Graham think that the interview will be embarrassing?
4 What is Harry's role in the story?
5 The German word Niemand means "nobody". Why do you think the author chose it for this visitor?
6 Why does Dr. Graham use the cruel term "idiot" for his son whom he clearly loves?
7 What point do you think the writer Frederic Brown is making in his story?

4D Describing the characters in the story. Which characters do the adjectives refer to? Why do you think so? Can any adjective be used for more than just one of the characters? Which ones?



4E In pairs, retell the story about the weapon with the help of the story wheel.



4F **Stories arise out of certain times. This short story was published in the early 1950s.**

1 Go online and find out about nuclear testing in the 1950s.
2 How is the story related to the time period it was written in?
3 If this story was set today, what weapon do you think the scientist might be working on?

4G **Debate. Work in pairs or small groups. Choose one of the following motions about weapons for a formal debate. Your teacher will show you instructions for a debate.**

- It is important for small countries to have weapons of mass destruction so they can protect themselves.
- It is morally unacceptable for a country to make weapons and sell them to other countries.
- For humanity to survive, governments must stop investing in weapons research.

4H **Choose one of the topics and write 150–250 words.**

A Invention(s) that the world would be better off without.

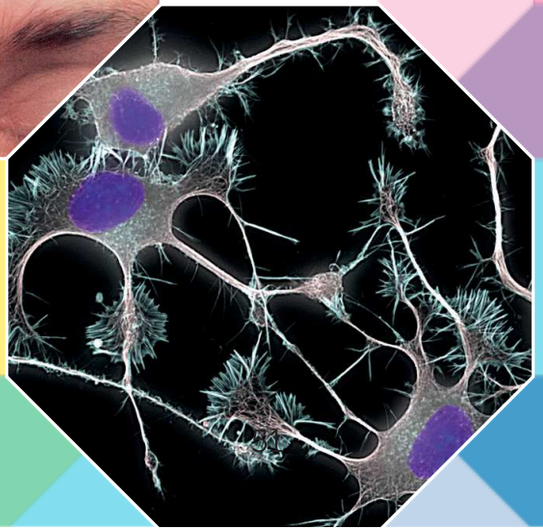
B What happens after this story ends? Write a continuation describing, for example, one of the characters a few years later.

C The day after Niemand's visit Dr Graham decides to write him a letter expressing his thoughts about the previous evening. Write the letter.

D Choose a classic fairy tale and use it in a story, like Frederic Brown uses *Chicken Little* in this science fiction story. You can rewrite the fairy tale or include its plot as an idea in your story.

UNIT 2

Stranger than fiction



Topic 5

Our mysterious world

The true mystery of the world is the visible, not the invisible.
(Oscar Wilde, Irish writer)

5A The song of the humpback whale is one of the most complex sounds in the animal kingdom. Why do you think whales sing? Discuss this with your partner. Then listen to the following comedy sketch for an alternative answer.

5B Mysterious places. Here are four places that are associated with mystery. Match them with the appropriate description.

1 Atlantis _____
2 Area 51 _____
3 Loch Ness _____
4 Stonehenge _____

A A lake in Scotland where people claim to have seen a large but elusive monster.
B A technically advanced island civilisation that vanished under the sea thousands of years ago.
C A massive prehistoric monument built on a grassy plain in the south of England.
D A top-secret US military base located in the Nevada desert.

5C Despite advances in science and technology there are many unsolved scientific mysteries in our world. Find a mystery to explore and research it online.

Tips
- Say why you chose this mystery.
- Show an image of the mystery on your phone or computer.
- Mention the place associated with the mystery.
- Describe the mystery.
- Describe possible explanations.

Form small groups and describe the mystery to your group.

Personal dictionary

5D **Read text 5. Find the words below in the text and underline them.**

- First, guess the meaning, then look them up in the vocabulary app if necessary and write them down on p. 58.
- Choose 3–5 extra words and mark them, too.
- Try making sentences with some of the words.

1 unravel
2 profound
3 prankster
4 breezy
5 camouflage
6 fatal
7 absent
8 persist
9 electrical current
10 confirm

5E **You are going to read or hear about three mysteries. After reading, answer the questions in Finnish.**

Topic 5 Key text

Nature's secrets

Scientists love a mystery. An opportunity to unravel a mystery in the natural world is an opportunity to understand our world more fully. And there is so much that continues to baffle us: the origins of life, the nature of time, the identity of dark matter, the causes of consciousness.

These are all profound questions about our universe, but sometimes mysteries come in smaller sizes, and can be solved, not through flashes of scientific brilliance, but through hard work and careful observation. Here are some small but perplexing puzzles that 21st century science has laid to rest.

The sailing stones of Death Valley

Visitors have long been puzzled by the sight of boulder tracks snaking across a dry lake bed in Death Valley National Park. The rocks' movement has been blamed on everything from space aliens and magnetic fields to pranksters, and the mystery is exacerbated by the fact that nobody has actually seen these stones in motion.

Now Dr Lorenz, a NASA scientist, has cracked the problem. His research team calculated that under certain winter conditions in Death Valley, enough water and ice could form to float the rocks across the cracked mud of the dry lake. On breezy days the heavy boulders are propelled forwards on thin, clear sheets of ice – a phenomenon known as "ice shove". It is paradoxical that in a place where rainfall averages two inches a year, rocks are being shifted by a mechanism typically seen in arctic climes.

The rocks don't slide around very often – only a few minutes out of a million – which explains why the event has not been noticed before.

1 Mainitse kolme asiaa, joilla aiemmin selitettiin kivien liikkumista.
2 Miten tri Lorenz selittää kivien liikkumisen?

→

The secret of the zebra's stripes

Over the years, zoologists have offered a range of explanations for the zebra's impressive stripes: they act as camouflage, they confuse predators, they regulate body heat, they help zebras to choose their mates. However, scientists at the University of California believe they have come up with the definitive answer. Having mapped the areas in which the species (and subspecies) of zebras, horses, and donkeys originally lived, they compared this data with the habitats of tsetse flies and tabanids like horseflies and deer flies. And they spotted a pattern. "I was amazed by our results," said Tim Caro, Professor of Wildlife Biology. "Again and again, there was greater striping on areas of the body in those parts of the world where there was more annoyance from biting flies."

The discovery that flies are averse to stripes dates back to the 1930s. Studies have shown that more flies are attracted by black surfaces, fewer by white surfaces and the fewest by stripes. Since the blood-sucking flies that live in the savannah can carry fatal diseases, it's imperative that zebras avoid this risk. That explains why equids living in areas where there are tsetse flies tend to come in stripes. And where the flies are absent, so too are those magnificently stripy coats.

3 Mainitse kolme selitystä, joita eläintieteilijät ovat antaneet seepran raidoille?
4 Minkä johtopäätöksen Tim Caro teki raidoista tutkimuksen perusteella?
5 Mikä yhteys raidoilla ja kärpäsillä on tutkimusten mukaan?

The puzzle of ball lightning

Sightings of these strange fiery orbs floating through the air or rolling along the ground have been around for centuries. Since they were usually spotted during thundery weather, it has long been suspected that they must be some kind of lightning. But, unlike split-second lightning flashes, these luminous spheres of energy, varying from a centimetre to several metres in diameter, can persist for many seconds.

Numerous explanations have been put forward. Could they be caused by microwave radiation? Or nuclear energy, antimatter or even black holes? Then, in 2007 a team of Brazilian scientists successfully created ball lightning in the lab. By passing a high electrical current through a silicon wafer they created a vapour that, once cooled, condensed into an aerosol that glowed when recombining with oxygen. Their lab video shows tiny balls of light rolling erratically around the floor, bouncing off objects, and burning whatever they touch.

The team proposed that a similar process was taking place outside the lab. When lightning strikes a surface, like the Earth's silica-rich soil, a vapour is formed which burns as it oxidises. Their theory was confirmed in 2012 when Chinese scientists managed to capture video footage of outdoor ball lightning. Spectrographic analysis of the vapour revealed silicon, iron and calcium – the same elements found in the local soil. Vaporised dirt, then. Not nearly as exciting as black holes.

6 Miten salama ja pallosalama eroavat toisistaan?
7 Mainitse kolme asiaa, jotka näkyvät laboratoriossa kuvatussa videossa?
8 Mitä kiinalaiset tiedemiehet vahvistivat?

unravel /ʌn'rævl/

---

baffle /bæfl/ hämmentää, saattaa ymmälle
origin /'ɒrɪdʒɪn/ alkuperä, synty
consciousness /kɒnʃəsnɪs/ tietoisuus, tajunta
profound /prə'faund/

---

universe /ju:nɪvɜ:s/ maailmankaikkeus
flash /flæʃ/ välähdys, salama; väläyttää
brilliance /brɪljəns/ nerokkuus, lahjakkuus, loisto
observation /ˌɒbzə'veɪʃn/ havainnointi, tarkkailu
perplexing /pə'pleksɪŋ/ hämmentävä, sekava
***lay to rest** /leɪ tə rest/ ratkaista, haudata
puzzled /pʌzld/ hämmentynyt, ymmällään
boulder /bəuldə/ lohkare, kivijärkäle
snake /sneɪk/ kiemurrella; käärme
blame /bleɪm/ moittia, syyttää; moite
prankster /præŋkstə/

---

exacerbate /ɪg'zæsəbeɪt/ pahentaa, kärjistää
motion /məuʃn/ liike, kulku; tehdä aloite
crack /kræk/ ratkaista, murtaa; halkeama, särö
float /fləut/ kellua, kelluttaa; koho, lautta
breezy /bri:zi/

---

propel /prə'pel/ liikuttaa, työntää
sheet /ʃi:t/ kerros, arkki; peittää
shove /ʃʌv/ sysäys; työntää
paradoxical /ˌpærə'dɒksɪkl/ paradoksaalista, näennäisesti järjenvastaista
rainfall /reɪnfɔ:l/ sademäärä
average /ævərɪdʒ/ muodostaa keskiarvo; keskiarvo; keskimääräinen
clime /klaɪm/ seutu
zoologist /zəu'ɒlədʒɪst/ eläintentutkija
impressive /ɪmxpresɪv/ vaikuttava
camouflage /kæməflɑ:dʒ/

---

predator /predətə/ peto, saalistaja
regulate /regjuleɪt/ säännellä, säätää
definitive /dɪ'fɪnɪtɪv/ määrätty, ratkaiseva, lopullinen
species /spi:ʃi:z/ laji, lajit
subspecies /sʌbˌspi:ʃi:z/ alalaji, alalajit

habitat /hæbɪtæt/ elinympäristö, elinpiiri
fly, flies /flaɪ, flaɪz/ kärpänen, kärpäset
tabanid /tə'bænɪd/ paarma
pattern /pætən/ kuvio, kaava, malli; kuvioida
annoyance /ə'nɔɪəns/ harmi, mielipaha, ärsyttäminen
averse /ə'vɜ:s/ vastahakoinen, haluton
fatal /feɪtl/

---

imperative /ɪm'perətɪv/ välttämätön, käskevä, ehdoton
equid /ekwɪd/ hevoseläin
tend to /tend tu/ olla taipumus, yleensä
absent /æbsnt/

---

magnificently /mæg'nɪfɪsəntli/ upean, mahtavan
sighting /saɪtɪŋ/ havainto
fiery /faɪəri/ tulinen, hehkuva, palava
orb /ɔ:b/ pallo, pyörä
thundery /θʌndəri/ ukkos-
luminous /lu:mɪnəs/ hohtava, kirkkaasti valaiseva
sphere /sfɪə/ alue, piiri
diameter /daɪ'æmɪtə/ halkaisija
persist /pə'sɪst/

---

radiation /ˌreɪdɪ'eɪʃn/ säteily
antimatter /æntimætə/ antiaine, antimateria
electrical current /ɪ'lektrɪkəl kʌrənt/

---

silicon wafer /sɪlɪkən weɪfə/ piikiekko
vapour /veɪpə/ kaasu, höyry
condense /kən'dens/ tiivistyä
glow /gləu/ hehkua; hehku
recombine /ˌri:kəm'baɪn/ yhdistää
erratically /ɪ'rætɪkli/ epävakaasti
bounce /bauns/ kimmota, hyppiä; pomppiminen
propose /prə'pəuz/ ehdottaa, kosia
silica-rich /ˌsɪlɪkə rɪtʃ/ piidioksidipitoinen
oxidise /ɒksɪdaɪz/ hapettua, hapettaa
confirm /kən'fɜ:m/

---

capture /kæptʃə/ tallentaa; valtaus
iron /aɪən/ rauta
calcium /kælsɪəm/ kalsium
soil /sɔɪl/ maaperä
dirt /dɜ:t/ maaperä, lika

INFO BOX

Earth words

Earth, soil, mud, and dirt can be used as synonyms. However, there are small differences between them.

- Earth (often with a capital E): the planet we live on.
  The Earth is the third planet from the sun.
- earth: a general word for the soft, loose material that covers much of our planet.
  He hired a mini digger to move the earth.
- soil: earth, but it is often used to express a type of earth.
  This plant grows best in sandy soil. (Not sandy earth.)
- mud: wet earth
  The car got stuck in the mud.
- dirt: an unclean substance such as mud, excrement or dust.
  Do you use a pressure washer to clean the dirt from your bike?

N.B. Dirt is used in American English as a synonym for earth.

5F **Work in pairs. Continue the sentences so that they are in keeping with the text, using your own words.**

1 Before Dr Lorenz solved the mystery of the boulder tracks, people claimed that...
2 The huge rocks move because...
3 The scientists studied the mystery behind the zebra's stripes by...
4 Zebras have stripes because...
5 Ball lightning is different from normal lightning in two ways:...
6 Should you see ball lightning, you should avoid it because...

Phrase hunt

5G **Find the following expressions in the text.**

1 tietoisuuden syyt _____

2 ovat kooltaan pienempiä _____

3 kovalla työllä _____

4 tietyissä talviolosuhteissa _____

5 useita selityksiä jllek _____

6 he ovat päätyneet ratkaisuun _____

7 mustat pinnat vetävät puoleensa

_____

8 missä ei ole kärpäsiä _____

9 toisin kuin sekunnin murto-osan kestävät salamat

_____

10 Ei läheskään niin jännittävä kuin

_____

5H **Translate the following sentences into English (1–3) and Finnish (4–6). The phrases in exercise 5G may help you.**

1 Tietyissä sääolosuhteissa tiet voivat muuttua vaarallisiksi.
2 On olemassa monia selityksiä sille, että kärpäsiä ei esiinny tietyillä alueilla.
3 Tutkijat päätyivät seuraavaan ratkaisuun: mustat pinnat vetävät kärpäsiä puoleensa, eivät raidat.

4 The rocks that move in Death Valley come in all shapes and sizes.
5 As a research topic, studying flies is not nearly as exciting as studying the causes of consciousness.
6 Unlike split-second lightning flashes, ball lightning, varying from a centimetre to several metres in diameter, can persist for many seconds.

51 Fill in the gaps with the following words.

breezy	offered	soil	confirmed	unlike	range
pattern	spotted	current	observations	rainfall	unravelled

Singing sand

In dry areas where there is little **1** _____ and the **2** _____ turns to sand, a curious phenomenon can be heard: singing sand. On **3** _____ days, a low, booming hum echoes across the sand dunes. Over the years a **4** _____ of explanations have been **5** _____: evil spirits, a slow-motion earthquake, an electrical **6** _____ generated by shifting sand. Recently, however, a series of scientific **7** _____ have **8** _____ the mystery.

A team of researchers noticed that **9** _____ most sand particles, which are rough and irregular, the particles of singing sands are round and smooth. They guessed this allowed the particles to slide more easily, rubbing against each other to create the sound. This theory was **10** _____ in the lab. By passing air through sand samples they created a similar hum – the sound of millions of little shocks. They also **11** _____ an interesting **12** _____: the larger the sand grains, the lower the hum.

5J Work in groups of three. Take a look at the word list on p. 58. Then, take turns to explain the words on the grid using your own words. The more difficult words will earn you more points! Keep a record of the number of points you and your group are able to earn together.

	1 point	**3 points**	**5 points**
1	zebra	thundery	prankster
2	mystery	pattern	camouflage
3	snake	breezy	profound
4	sheet of ice	zoologist	persist
5	fatal	electric current	radiation

5K Solve the mystery. Lateral thinking puzzles often describe unusual situations in which you are given a little information and then have to find the answer. You have to be creative in your thinking in order to solve the mystery.

Example

Puzzle: Five large people try to crowd under one normal-sized umbrella, and nobody gets wet. How is it possible?

Answer: It's not raining.

Form small groups. Take turns reading the following puzzles aloud and discussing possible answers.

1. A blind beggar had a brother who died. What relation was the blind beggar to the brother who died? (Brother is not the answer).
2. A man rode into town on Friday. He stayed for three nights and then left on Friday. How come?
3. Two dads and two sons go fishing. They each catch a fish, yet come home with three fish. Why?
4. A police officer was sitting on his motorcycle at a red traffic light when two teenagers in a sports car drove by him at 50 mph. He did not chase them or try to apprehend them. Why not?
5. A man was walking near some railroad tracks. Even though a train comes straight towards him, he is not harmed. How is this possible?
6. A horse jumps over a tower and lands on a queen who then disappears. What's going on?

5L Write your own sentences using the following words. Use one word from each column in each sentence. You can use them in any order. You may change the form of the words.

noun:	adjective:	verb:
zebra	thundery	run
snake	fatal	glow
ice	breezy	persist
mystery	profound	capture
zoologist	magnificent	confirm
object	impressive	spot
universe	black	bounce

Example
A bite from a rattlesnake can be fatal, so make sure you spot them before they spot you.

5M Listen to two friends talking about the Ig Nobels. Answer the questions in Finnish.

Weird science: the Ig Nobels

Everybody knows about the Nobel Prize. But do you know about the Ig Nobel awards? This prize rewards those research projects that first make people laugh, and then make them think. The ten annual prizes celebrate the unusual and the imaginative. They come with little cash, but much cachet as they spur people's interest in science, medicine, and technology.

A bra with a difference.

1 Mikä tavallisesta poikkeava käyttö rintaliiveille keksittiin?
2 Minkälaisia myöhään valvovat ihmiset tutkimuksen mukaan ovat?
3 Miten kiroilututkimus suoritettiin?
4 Mikä oli tutkimuksen tulos?
5 Mikä tutkimus poninhännästä tehtiin?

5N Explaining a natural phenomenon. Science often has an explanation for natural phenomena such as lightning. Here is a way to structure an explanation.

- **Define the phenomenon.**
  Lightning is an electrical discharge in the atmosphere.
  The electricity in a bolt of lightning varies from 10 million to 100 million volts.

- **Focus your explanation with a question.**
  So how does lightning form?

- **Describe the process step by step.**
  Well, first/firstly/initially, the sun warms the ground.
  The process begins with the sun warming the ground.

  Then/next/after that the air above the ground heats up.
  This, in turn, warms the air above the ground.

  Once the air is warm, it begins to rise.

  When the warm air meets a cloud, it disturbs the water or ice particles inside the cloud.

  This causes tiny collisions that create an electrical charge.

  Finally, when enough of a charge has built up, it is suddenly released through a bolt of lightning.

- **Add examples from ordinary life to illustrate your point.**
  For example, if you rub a balloon you get static electricity.
  A similar thing is happening here.
  It's a bit like the static electricity you get when you rub a balloon.

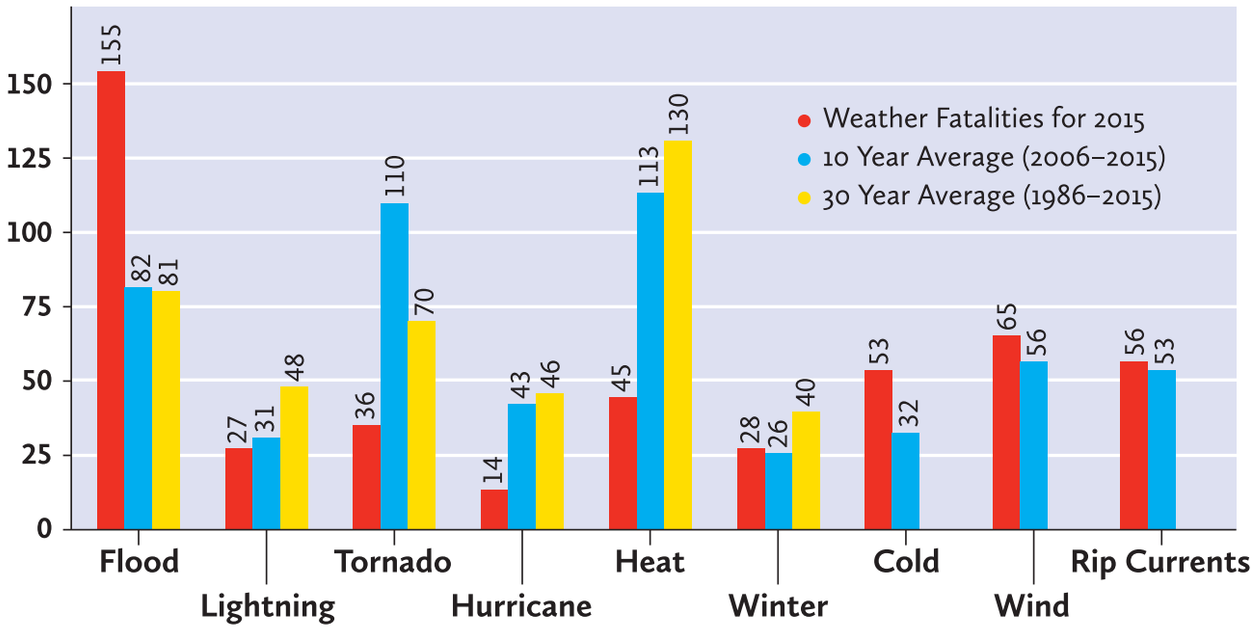
For more information on linking the words, see the online *How to write* section.

Choose one of the natural phenomena from the list below.
Do a little research and then explain it to your partner. You may use diagrams, graphs or tables to help you.

- Rainbows: How are they formed?
- Tornadoes: What causes these storms?
- Ice formation: Why does ice start to form on the top of a lake?
- Air temperature inversion: How can a hilltop in winter be warmer than a valley?
- The Aurora Borealis: What causes the Northern Lights?
- The Brocken spectre: How is this illusion created?

50 Safety guide. Write a short online article advising Americans about the dangers posed by extreme weather (about 150–250 words). Use the bar chart below to help you.

Weather fatalities in the USA



© *The National Climatic Data Center*

STUDY TIP

Writing a short text explaining a graph

- Explain what the graph aims to show. The title usually tells you this.
- Summarise the information.
- Mention the overall trend, but highlight the differences too.
- For more information, see the online *How to write* section.

Topic 6

The last frontier

Biology gives you a brain.
Life turns it into a mind.
(Jeffrey Eugenides, American writer)

Is that your brain?

6A **Are you a risk taker? Take our short quiz to find out whether you like to live on the edge, or whether you usually opt for the safer option.**

The wild life

1 You're driving to meet some friends, and you're running late. The traffic light ahead turns yellow. What do you do?
   a) You always stop at yellow, no matter what.
   b) Break and stop at the light. You're late anyway.
   c) Put your foot down and race through the intersection.

2 Which of the following holidays would you prefer?
   a) An overland expedition from Cape Town to Cairo.
   b) A summer at a cabin in Lapland.
   c) A week-long mini cruise on a luxury liner.

3 What would you do with your money if you won the lottery?
   a) Deposit it in a bank, saving it for a rainy day.
   b) Spend some, save some, give some to your parents.
   c) Buy all the things you've always wanted to have.

4 How would you like people to see you?
   a) Wild and exciting.
   b) Good-natured and kind.
   c) Witty and clever.

5 You're on holiday in Australia. Which of these activities appeals to you the most?
   a) Hanging out on the beach, making new friends.
   b) Learning to surf and snorkel.
   c) Going on an organised trip to the outback.

6 Someone you fancy at school smiles at you in the hallway between classes. What do you do?
   a) Blow him or her a kiss.
   b) Smile back and say hi.
   c) Avoid eye-contact and blush.

7 You're with a friend in India. You walk into a tent where there is a cobra in a cage. People are queueing up to pay ten dollars for a chance to grab the ten one-hundred dollar bills lying on top of the snake's cage. What do you do?
   a) Leave.
   b) Stick around to see the free show.
   c) Take out your ten bucks and get in line.

8 You have an important exam tomorrow. Your neighbours invite you to a wild party at their summer place. Will you go to the party?
   a) You go, but you return home early.
   b) Definitely!
   c) Of course not.

How to score

1:	a) 3	b) 2	c) 1	**5:**	a) 2	b) 1	c) 3
2:	a) 1	b) 3	c) 2	**6:**	a) 1	b) 2	c) 3
3:	a) 3	b) 2	c) 1	**7:**	a) 3	b) 2	c) 1
4:	a) 1	b) 2	c) 3	**8:**	a) 2	b) 1	c) 3

What your score means

17–24 You appear to be level-headed, but slightly timid. You rarely take risks, and prefer to stick with what you know. Life is for living, and you shouldn't be afraid to take a chance every now and then.

9–16 You know how to have a crazy, fun time without putting yourself or others at risk. Stay the way you are and have fun!

1–8 Wow! You're a real risk-taker, aren't you? And you like to hang out with people who feel the same way, too. But your need for thrills and excitement could land you into some tricky, if not downright dangerous, situations. Take time to think before you do something risky.

6B **In pairs, take turns answering the questions in English.**

What can you do about addictions?

Are you addicted to anything? Things like coffee, energy drinks or other substances?

What do you think is the reason for any of your addictions? Are some people more prone to addiction than others?

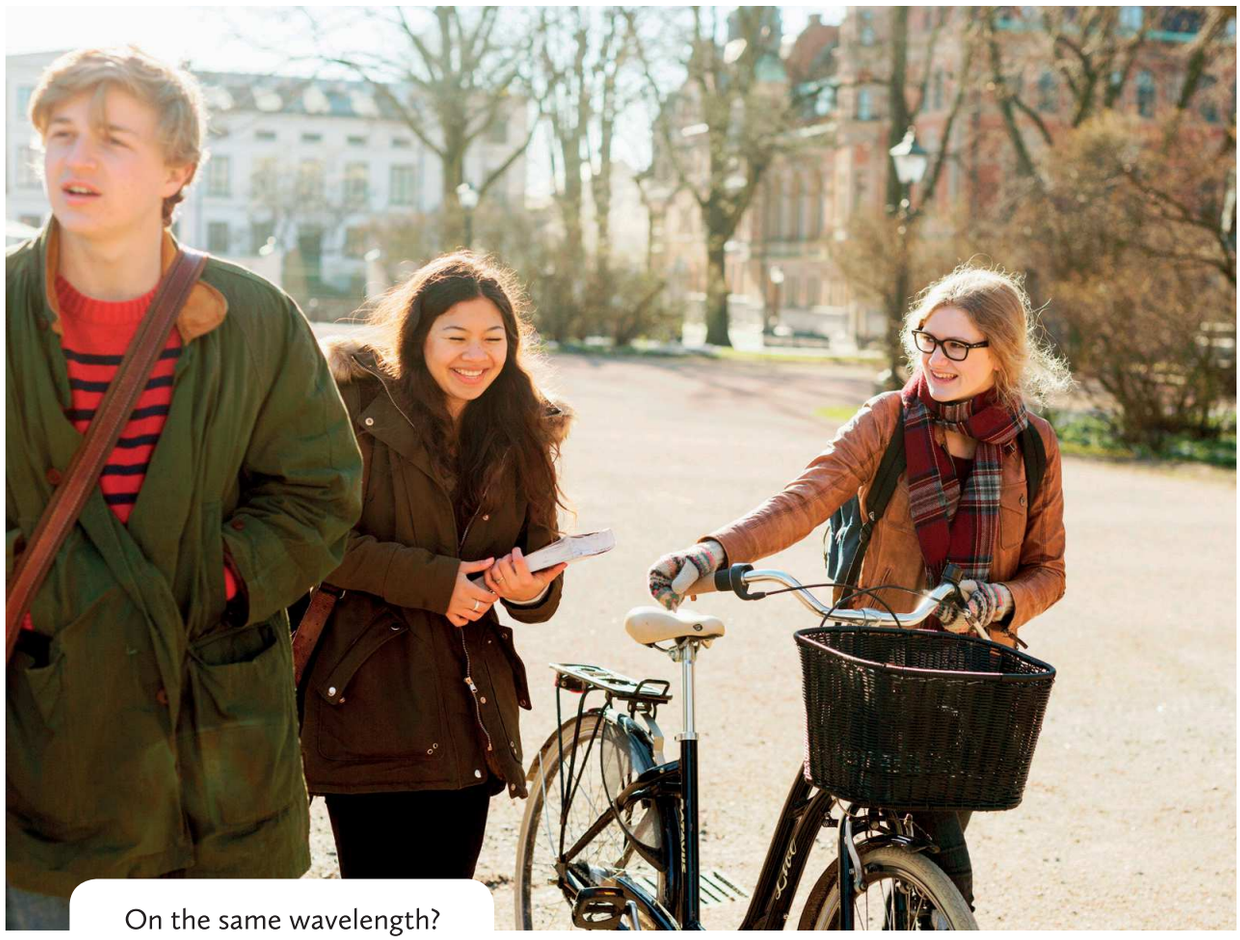
What happens if you can't get the substance you are addicted to?

Would you regard yourself, or someone you know, as a shopaholic?

Do you think you may be somewhat addicted to social media, video games or online gambling? Do you know anybody who is?

Have you ever felt the urge to exercise even if you did not have the time for it or you were a little ill? Can sports be addictive?

The funny thing about your brain is that it interprets all pleasures in the same way, whether it is coffee, winning a game or buying something fancy from a shop. Pleasure releases dopamine, the neurotransmitter, and this affects your brain right in the pleasure centre.



On the same wavelength?

Personal dictionary

6C **Read text 6. Find the words below in the text and underline them.**

- First, guess the meaning of the words, then look them up in the vocabulary app if necessary and write them down on p. 74.
- Choose 3–5 extra words or phrases and mark them, too.
- Try making sentences with some of the words.

1 substance
2 remorse
3 peer pressure
4 reasoning
5 reward
6 mating
7 adolescence
8 irrational
9 intersect
10 alter

Topic 6 Key text

Young and reckless: exploring the adolescent brain

Teenagers can do the craziest things. They drive at high speeds. They turn up their music to the point of permanent damage to their hearing. They guzzle liquor like water. They try forbidden substances. They insult and lie to their parents, feeling no remorse, because, of course, anyone older than 20 is an idiot. They climb and jump, spin and dive as if they are immortal, never thinking about the possible consequences of an injury.

Clinical psychologist, Dr Jennifer Brown, gave a talk about the perplexing adolescent brain at a conference in Adelaide, Australia.

Good afternoon, everybody. I'm Jennifer Brown, and I'm here to talk to you about that most mysterious thing: the adolescent brain. We often blame the wild, out-there behaviour of young people on peer pressure or social media, but scientific studies suggest that at least some of this crazy behaviour can be blamed on the way the adolescent brain develops. Scanned images clearly show how the average teenager's brain differs from an adult's. The biggest differences seem to lie in the prefrontal cortex – a part of the brain associated with reasoning – and in brain cells linking the cortex to areas of the brain that relate to our emotions.

→

Peers, sex and risky behaviour

Research done by Laurence Steinberg, a psychology professor at Temple University, looked at something called the reward circuitry, or the pleasure centre, in the brain. He found that the reward circuitry is more active when adolescents are with their peers, compared to when adults are with their peers. Basically, young people feel good being around people their own age, which is as it should be. Mating typically starts during adolescence, and from an evolutionary point of view it is of course better to have sex with people closer to you in age, and definitely outside the family circle.

Those reward circuits may also provide a hormonal jolt that leads to risky behaviour, like racing cars on slippery ice to impress your peers, for example. Adolescents are much more susceptible to social feedback than adults. So, it comes as no surprise that they often tend to do what they think their peers might want them to do, regardless of how irrational this behaviour may appear to the rest of us. However, there are two sides to this coin. Those very elements that make young people take scary risks, may also motivate them to set out on their own, explore the world and seek new experiences. And society needs teenagers to be fearless, to push the boundaries, explore and create new things. Our very survival may depend on it.

The power of the teenage brain

Deep inside the brain, at the point where a straight line from your eye and your ear would intersect, lies the amygdala, the brain's emotional processor. It plays a key role in forming emotional memory – feelings of fear, happiness, excitement, sorrow – basically all emotions. This area of the brain is much more active in teenagers than in adults. An overactive amygdala would therefore go a long way towards explaining those intense feelings of excitement, aggression and depression teenagers often experience. When I explain to stressed out teenagers that it's probably their sensitive amygdala that causes them to feel things so intensely, they are usually relieved that there is a physiological explanation for those feelings of stress and anger.

Neurologists disagree

As you might expect, some neurologists are concerned that too much is being made of brain scan images. Thomas Paus, Professor of Psychology and Psychiatry at the University of Toronto, for example, feels that it is not our brains changing our experience, but rather our experience that alters our brains. He rightly points out that a 17-year-old and a 40-year-old have very different experiences of life. On average, young people are physically more active, and their diet is often quite different from that of adults too. He says that while those scanned neurological images are powerful, and helpful, they are not actual causes of behaviour. In his opinion, people mainly behave the way they do because of their genes and their environment, not because of the way their brain develops.

One thing all neurologists, psychologists and psychiatrists do agree on is that as far as the brain is concerned, we still have a lot to learn. Forget about Mars and space, the brain is the final frontier.

The phrase "the final frontier" can be used for investigating new areas, such as exploring space or the human brain. It can also refer to artificial intelligence.

reckless /'rekləs/ uhkarohkea, vastuuton, harkitsematon
adolescent /ˌædə'lesnt/ nuori, murrosikäinen
permanent /pɜːmənənt/ pysyvä
damage /dæmɪdʒ/ vahinko; vahingoittaa
guzzle /gʌzl/ kitata, ryypiskellä
liquor /lɪkə/ viina
forbidden /fə'bɪdn/ kielletty
substance /sʌbstəns/

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insult /ɪn'sʌlt; ɪnsʌlt/ loukata, kohdella loukkaavasti; loukkaus, solvaus
remorse /rɪ'mɔːs/

---

immortal /ɪ'mɔːtl/ kuolematon
consequence /kɒnsɪkwəns/ seuraus, seuraamus, johtopäätös, tulos
injury /ɪndʒəri/ vahinko, loukkaantuminen, vamma
clinical psychologist /klɪnɪkl saɪ'kɒlədʒɪst/ kliininen psykologi
perplexing /pə'pleksɪŋ/ hämmentävä, sekava, monimutkainen
blame on /bleɪm ɒn/ syyttää jstak
out-there /aut'ðeə/ outo
peer pressure /pɪə preʃə/

---

scientific studies /ˌsaɪən'tɪfɪk stʌdɪz/ tieteelliset tutkimukset
images /ɪmɪdʒɪz/ kuvat
differ from /dɪfə frɒm/ erota jstak
prefrontal cortex /prɪfrʌntl kɔːteks/ (aivojen) etuotsalohkon kuori
associate with /ə'səusɪeɪt wɪð/ yhdistää, liittää
reasoning /riːzənɪŋ/

---

brain cell /breɪn sel/ aivosolu
cortex /kɔːteks/ aivokuori
relate to /rɪ'leɪt tu/ olla yhteydessä johonkin, liittyä johonkin
emotion /ɪ'məuʃn/ tunne, emootio
reward /rɪ'wɔːd/

---

reward circuitry /rɪ'wɔːd sɜːkɪtri/ mielihyväkeskus
pleasure centre /pleʒə sentə/ mielihyväkeskus
mating /meɪtɪŋ/

---

adolescence /ˌædə'lesns/

---

evolutionary /ˌevə'luːʃənri/ evoluutioon liittyvä, evoluution
hormonal /hɔːməunl/ hormoni-, hormoneihin liittyvä
jolt /dʒəult/ heiluttelu, isku, kolaus, täräys, heiluttelu, yllätys; täristää, järkyttää
susceptible to /sə'septəbl tu/ vastaanottavainen, altis, herkistynyt, herkkä
regardless of /rɪ'gɑːdlɪs əv/ välittämättä jstk, huolimatta jstk
irrational /ɪ'ræʃənl/

---

appear /ə'pɪə/ näyttää, tuntua, ilmestyä
explore /ɪk'splɔː/ tutkia, tehdä tutkimusmatka
fearless /fɪəlɪs/ peloton
survival /sə'vaɪvl/ henkiinjääminen
intersect /ˌɪntə'sekt/

---

amygdala /ə'mɪgdələ/ mantelitumake, amygdala
emotional /ɪ'məuʃənl/ emotionaalinen, tunneperäinen, tunne-, tunteisiin vetoava
processor /prə'sesə/ käsittelijä, suoritin, keskusyksikkö
sorrow /sɒrəu/ suru, murhe
overactive /ˌəuvər'æktɪv/ yliaktiivinen
stressed out /stresd aut/ stressaantunut, ahdistunut
sensitive /sensɪtɪv/ herkkä
intensely /ɪn'tensli/ rajusti, syvästi, intensiivisesti
relieved /rɪ'liːvd/ helpottunut, huojentunut
neurologist /ˌnjuə'rɒlədʒɪst/ neurologi, neurologian erikoislääkäri
concerned /kən'sɜːnd/ huolestunut, osallinen, kyseinen
brain scan images /breɪn skæn ɪmɪdʒɪz/ pään magneettikuvat
alter /ɔːltə/

---

point out /pɔɪnt aut/ osoittaa, huomauttaa, näyttää
on average /ɒn ævərɪdʒ/ keskimäärin, yleensä
scanned neurological images /skænd ˌnjuərə'lɒdʒikl ɪmɪdʒɪz/ pään magneettikuvat

6D Choose the alternative that is in keeping with the text.

Introduction (lines 1–27)

1 What is the most probable reason for teenagers' risky behaviour?
   a) They want to show off.
   b) They feel peer pressure, especially now that they use social media so much.
   c) The development of the teenage brain.

2 Scanned images of the brain show that
   a) the adult brain ignores emotions whereas the teenage brain does not.
   b) the adult brain differs from the teenage brain in the area that handles reasoning.
   c) the adult brain differs from the teenage brain when it comes to size.

Peers, sex and risky behaviour (lines 28–46)

3 The reward circuitry in the adolescent brain
   a) is very active when teenagers are with their friends.
   b) makes young people spend more quality time in their family circle.
   c) makes them sexually active.

4 The survival of mankind may depend on
   a) the hormonal jolt that makes young people take dangerous risks.
   b) the fear felt by young people when faced with dangerous situations.
   c) irrational behaviour caused by peer pressure.

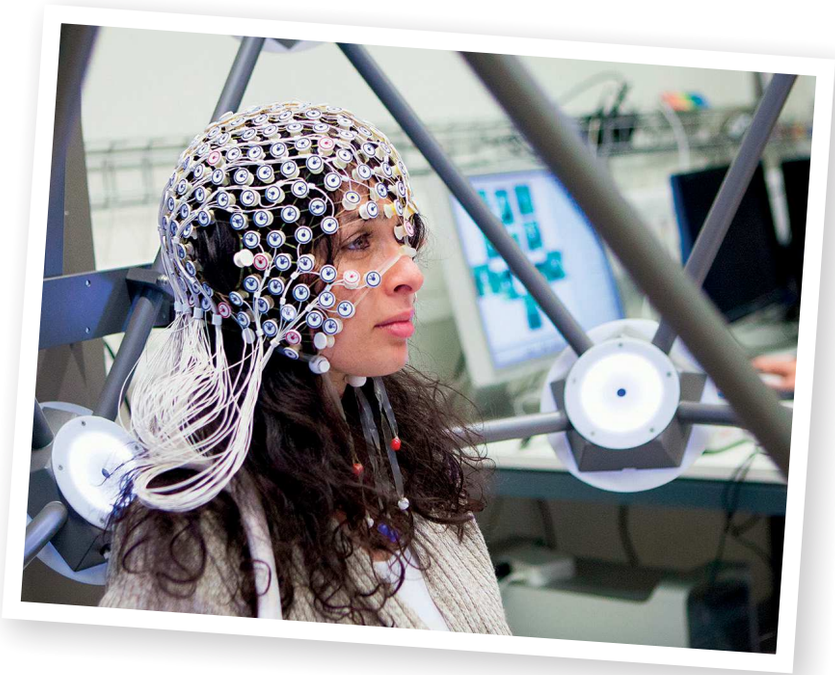
The power of the teenage brain (lines 47–57)

5 What is said about the amygdala?
   a) It coordinates your sight and hearing.
   b) It is related to your emotions.
   c) Only teenagers have an active amygdala.

Neurologists disagree (lines 58–72)

6 According to Thomas Paus
   a) the adult brain is fully developed at the age of 40.
   b) people's behaviour mainly depends on their brain development.
   c) our diet may influence our behaviour.

We know what you're thinking.



6E Dr Jennifer Brown made a slide show for her presentation at the Adelaide conference. You can see her slides here. In pairs, discuss the main points using the key words she picked for her slides.

1

The perplexing adolescent brain: examples of teenage behaviour

2

Reasons for out-there behaviour of young people

3

Scanned images

4

Reward circuitry active

5

Social feedback

6

The amygdala – the brain's emotional processor

7

Controversy between neurologists

8

Actual causes of behaviour

6F After Dr Brown's presentation the audience has an opportunity to ask some questions. Write the questions. The answers are given. The first one has been done for you.

1 Where in the brain does reasoning take place?
Answer: In the prefrontal cortex.

2 _____?
Answer: It could be due to a hormonal jolt provided by the reward circuits.

3 _____?
Answer: Because it may help humankind to survive.

4 _____?
Answer: It is the brain's emotional processor.

5 _____?
Answer: Young people may feel excitement, aggression or depression very intensely.

Phrase hunt

6G Find the following expressions in the text.

1 keskiverto teini-ikäisen aivot eroavat aikuisen (aivoista)
_____

2 aivojen osa, joka yhdistetään jhk
_____

3 evoluution näkökulmasta _____

4 tehdä vaikutus ikätovereihisi _____

5 asialla on kaksi puolta _____

6 saattaa riippua siitä _____

7 Se on avainasemassa _____

8 on olemassa fysiologinen selitys _____

9 johtuen heidän geeneistään ja ympäristöstään
_____

10 mitä aivoihin tulee _____

6H **Fill in the gaps with the help of the Finnish clues. Look at the expressions in exercise 6G for help.**

Jung and Freud

The different theories of Carl Jung and Sigmund Freud **1** _____ (ovat avainasemassa) in our perception of the human mind. Jung **2** _____ (eroaa) Freud in that he didn't place so much emphasis on the role of sexual impulses. **3** _____ (mitä Jungiin tulee), Freud's concept of the unconscious was too limited. Freud focused on the personal unconscious, while Jung thought the unconscious was **4** _____ (yhdistää johonkin), the collective unconscious of all mankind.

But they both probably agreed that, **5** _____, (evoluution näkökulmasta) the simplest definition of intelligence would be the ability to learn. Our lives **6** _____ (saattaa riippua siitä). Those who don't learn from experience, don't survive. When it came to dreams, Freud thought they were a disguised attempt at wish fulfilment. Jung was more interested in common dream symbols. Researchers today wonder if there is **7** _____ _____ (fysiologinen selitys jollekin) why we dream. Some claim that we dream in order to exercise various neural connections.

6I Choose the correct preposition.

1 Everybody dreams, **on** / **with** / **at** average, about two hours a night.
2 Dr William C. Dement was the first researcher to associate dreams **in** / - / **with** REM sleep.
3 Later, research done **in** / - / **by** Dr N.C. Rattenborg indicated that birds show signs of REM sleep too.
4 This raises an interesting point. Just think **on** / **about** / **after** it: if people dream of flying, do birds dream of walking?
5 Are the dreams of a hawk different **of** / - / **from** those of a chicken?
6 Other researchers have pointed **after** / **to** / **out** that while mammals show signs of REM sleep, reptiles do not.
7 I met Dr Dreamboat **at** / - / **over** a conference in Maryland, where he was giving a paper on the meaning of dreams.
8 Apparently people were always asking him to give an explanation **by** / **on** / **for** some nightmare they may have had.
9 He said that bad dreams can often be blamed **for** / **on** /**after** eating rich food late in the evening.
10 I could relate **to** / - / **with** that. If I have chocolate cake just before going to bed, I'll definitely have strange dreams.

6J Translate the sentences into English.

1 Vaikutuksen tekeminen ikätovereihin on tärkeää joillekin teini-ikäisille.
2 Evoluution näkökulmasta henkiinjäämisemme saattaa riippua pelottomasta käytöksestä.
3 Mitä Jungiin tulee, unien näkeminen on olennaista mielenterveydellemme.
4 Jotkut asiantuntijat sanovat, että myös geenit ja ympäristö ovat käytöksessämme avainasemassa, eivät pelkästään fysiologiset tosiasiat.

INFO BOX

Brain or brains?

These two words are often mixed up. However, the general rule is:

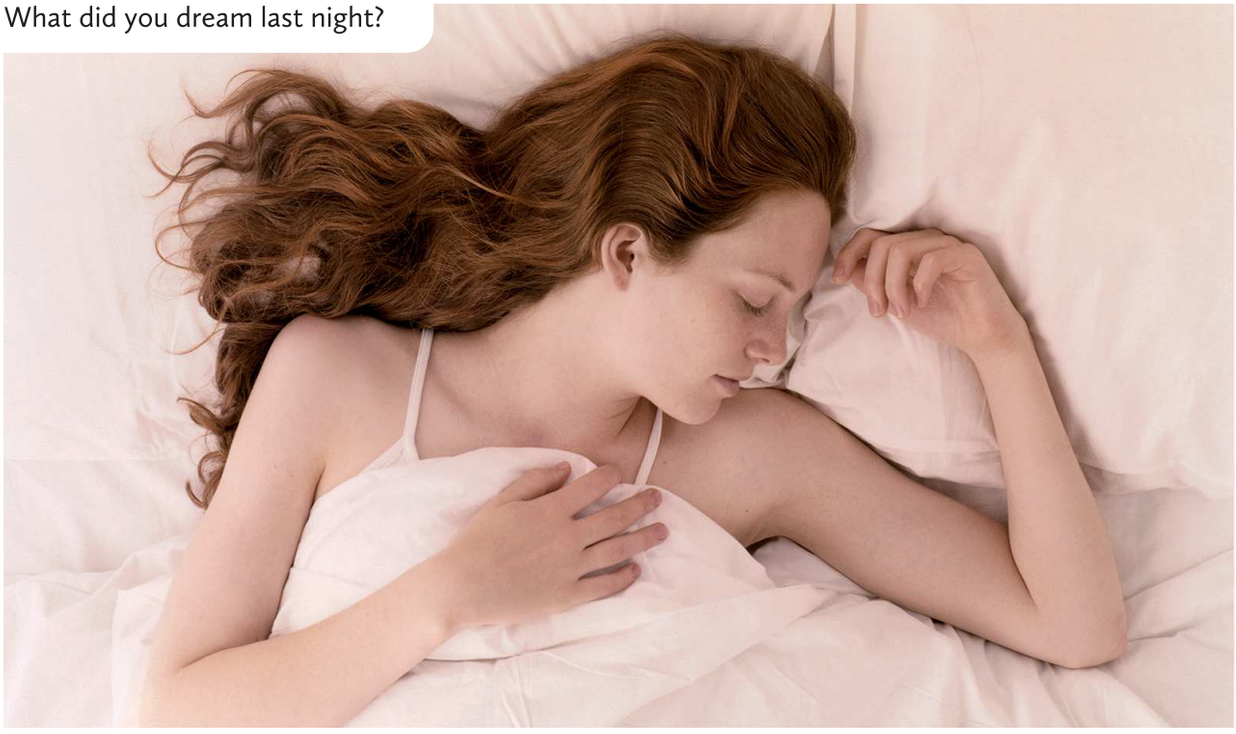
- brain = the organ inside the head that enables us to think.
  e.g. The average adult brain weighs about 1.4 kg.
- brain**s** = intelligence
  e.g. You need brains to do this job.

Of course, there are exceptions. Descriptions of violence, for example, often use brains. e.g. The gangster grabbed the bank clerk and threatened to blow his brains out.

6K **Discuss the following questions in pairs.**

1 Do you generally sleep well?
2 Do you remember your dreams in the morning?
3 Why do you think some of your dreams feel so much more real than others?
4 What is the strangest dream you have ever had?
5 What did you dream about last night?
6 Have you ever noticed a connection between your daily activities and your dreams?
7 Have you ever written your dreams down?

What did you dream last night?



6L Listen to the following interview about dreams.

Dream on...

The online magazine *Mindful* asked people about the strangest dream they'd ever had. Here are three responses:

- I met a talking lion.
- Hundreds of alligators were trying to get into my house through doors, windows – even down the chimney.
- A zombie ate my right hand. I'm a piano teacher.

Tick the items that are mentioned.

- ☐ whales swimming
- ☐ shark attack
- ☐ red meat
- ☐ relatives
- ☐ ex-partner
- ☐ snakes
- ☐ snails
- ☐ raincoats
- ☐ Ireland
- ☐ fuel
- ☐ the Queen of England

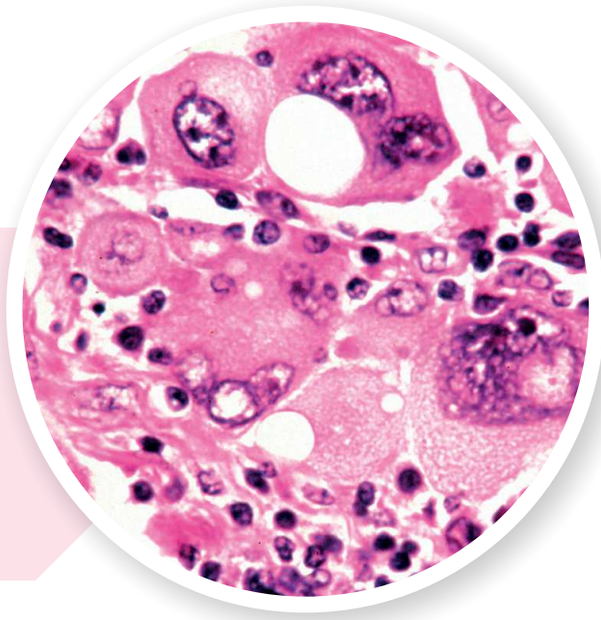
6M Survey. In teams, plan and conduct a survey in English. See the online *How to write* section for help. Present your results to the class or write about the results. Choose one of the following topics.

A Dreams
B Techniques for reducing stress
C Good ways of learning new skills
D Effective ways of memorising new information

You can use your psychology course books to help you design your survey questions.

Topic 7

Medical vocabulary



The future of medicine

Rapid advances in the field of medicine may change our lives in unexpected ways. Here are some of the developments we might expect to see in the future.

7A First listen to the following news report.
The words in colour relate to the field of medicine.
Match the words to the Finnish translations in the box.

Dr Dog

Whenever Beth Carlson sat on the sofa, her dog would start licking her left ankle. She mentioned this to her **GP** during a routine **check-up**. He took a look at her ankle, but didn't find anything abnormal. Nevertheless, on top of the usual **blood** and **urine samples**, he also took a **biopsy** from a small mole growing just above her ankle.

Three days later, the lab results came through: the mole was a **melanoma** – a **malignant tumour** associated with **skin cancer** – and it had to be removed immediately. Thanks to the early diagnosis, the **operation** was a complete success: the cancer was caught before it could spread, and Beth made a full **recovery**.

This is not the first time dogs have detected particular health problems in their owners. There are reports of dogs sniffing out infections like **sinusitis**, **pneumonia** and **tonsillitis**, predicting **seizures** and **heart attacks** before they happen, as well as warning owners about low **blood sugar levels**. This uncanny ability comes down to the dog's highly developed sense of smell.

Many **illnesses** make our bodies exhale a distinct chemical signature which is created by the **germs** or malfunctions that cause the disease, and the body's efforts to fight them. A dog's nose is sensitive enough to detect this scent, long before the owner – or even a doctor – becomes aware of any **symptoms**.

Scientists are now working on electronic noses – devices that identify the specific components of an odour and analyse its chemical components. It remains to be seen how well these e-noses compare to the natural nose of a dog.

angiina _____

bakteeri _____

ihosyöpä _____

keuhkokuume _____

koepala _____

kohtaus _____

leikkaus _____

lääkärintarkastus _____

melanooma _____

oire _____

pahanlaatuinen kasvain

_____

poskiontelontulehdus _____

sairaus _____

sydänkohtaus _____

toipuminen _____

verensokeriarvo _____

verinäyte _____

virtsanäyte _____

yleislääkäri _____

7B Listen to the following news item. Fill in the gaps according to what you hear.

Your smart phone will see you now

Smart phones already help to keep us fit. There are plenty of apps to motivate us, coach us and track our progress. Now the smart phone is at the forefront of a **1** _____ revolution which aims to keep us healthy, too.

A vast array of new tools – from attachments that can diagnose an **2** _____ or track heart rhythms to an app that can monitor **3** _____ – can reduce our use of doctors, cut costs, speed up the pace of care and give us more control over our own health.

Our mobile devices allow us to capture and process vast amounts of data. This means that input from sensors can provide us with information about **4** _____, glucose levels, oxygen concentration in the blood, heart rhythm, lung function and mood. In addition, most routine labs can be carried out at home with a fingerstick and a smartphone attachment. With a droplet of blood you can run your own **5** _____, **6** _____ and thyroid function tests as well as blood counts. If you have a **7** _____, just take a photo and an app will text you with your **8** _____. It will even offer advice on what **9** _____ you need or whether you should book an appointment with a dermatologist.

Mobile health – or mHealth as it is often called – will transform the way in which we experience **10** _____. It does not mean the end of visits to the doctor, but we should expect a lot more consultations with the digital doctor in our pocket.

7C Read through the hints and fill in the answers with the help of the Finnish clues.

blood vessels	cells	organ	transplant operation
body parts	donor	paralysed	tissue
burns	immune system	rejection	veins
cartilage	medication		

Grow your own organs

With people living longer than ever, being able to replace human **1** _____ (ruumiinosat) as they wear out is a growing concern. One solution is the traditional **2** _____ (elinsiirtoleikkaus) where a failing body part is replaced with an **3** _____ (elin) from a willing **4** _____ (luovuttaja). Unfortunately, this can mean a wait of up to a year until the right organ becomes available. And then there is the risk of the patient's **5** _____ (immuunijärjestelmä) rejecting the new tissue, not to mention the expense of life-long **6** _____ (lääkitys).

That is why there is a strong interest in lab-grown organs. The hope is that one day doctors will be able to grow organs as 'spare parts' to replace damaged or diseased **7** _____ (kudos). Since these body parts are grown from a patient's own **8** _____ (solut) there is little risk of **9** _____ (hylkiminen).

Bioengineered skin is already used for grafts to treat people with **10** _____ (palovammat), and trials are underway to repair knees with lab-grown **11** _____ (rusto). Tissue engineers are also working to create whole organs. New hearts, livers, and kidneys have the potential to save and extend human lives. New **12** _____ (suonet) will allow blood to bypass blocked **13** _____ (verisuonet), while lab-grown nerve fibres could breathe life back into **14** _____ (halvaantunut) limbs. In years to come we may be visiting labs filled with jars containing hearts, livers and kidneys that can be taken off the shelf and tailored especially for us.

Topic 8

Read on

The saddest aspect of life right now is that science gathers knowledge faster than society gathers wisdom.
(Isaac Asimov, American science fiction writer)

A science fact
"Humans share approximately 98% of their DNA with chimps, 70% with slugs, and 50% with bananas."

8A **In pairs, give your opinion about each statement. Do you agree or disagree? Explain the reasons for your choice.**

1 Couples should be allowed to choose the gender of their baby.
2 I would like to clone my pet once it becomes affordable.
3 Scientists should store the genomes of wild animals to save endangered species.
4 Genes from different animals should be used to create brand new species.
5 Cloning people is a good idea.
6 Genetic engineering should be used on humans to eliminate genetic diseases.
7 Athletes should be allowed to use gene doping, such as injecting DNA into their bodies to improve athletic performance.
8 To protect our country, scientists should genetically engineer effective soldiers for the armed forces.

gender sukupuoli
affordable edullinen
genome genomi, eliön koko perimä
endangered species uhanalaiset lajit
genetic engineering geenitekniikka
inject ruiskuttaa, pistää

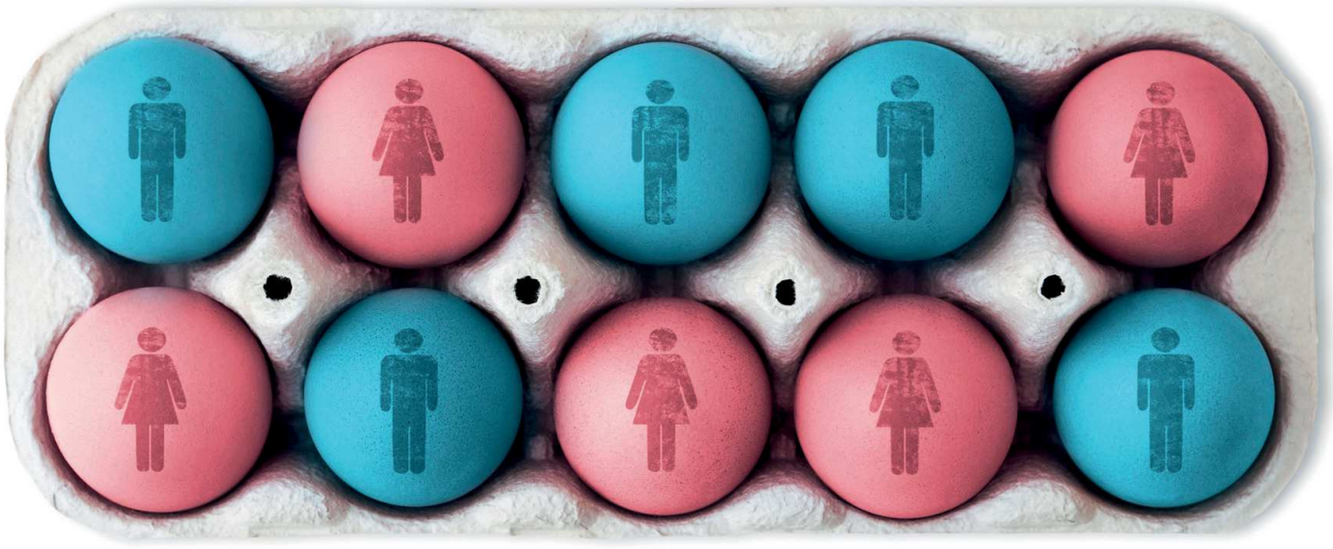
Topic 8

Stronger, faster, smarter: the rise of the designer baby

Genetically modified animals are nothing new. By extracting a gene that produces fluorescence in a jellyfish and inserting it into a zebrafish, scientists created a fish that glows in the dark. They have also engineered goats to produce human drugs – and even spider silk – in their milk. While tinkering with animal DNA has aroused considerable controversy, this is nothing compared to the arguments caused by altering the genetic make-up of human beings.

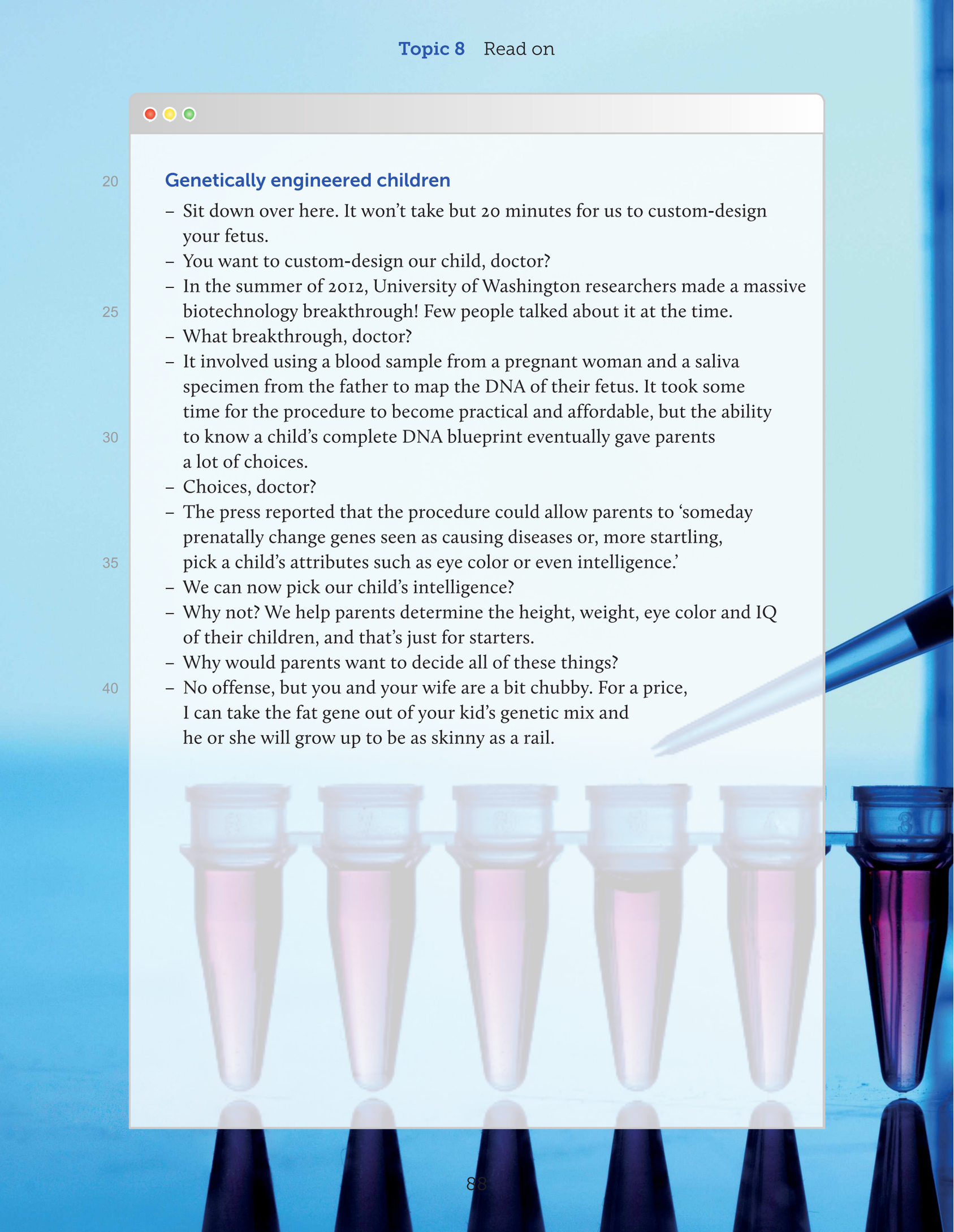
Yet, being able to engineer precise changes in human DNA has some obvious advantages. It allows us to eliminate mutations that give rise to hereditary disorders such as cystic fibrosis or various kinds of blindness – a boon to children and their parents who would otherwise have to live with these problems. Nevertheless, some ethicists worry that these same techniques could open the door to genetic modification procedures that would go well beyond improving a child's health. By adding or removing specific genes it is possible to change a baby's height or intelligence or hair color. What will happen if this technology becomes available to prospective parents? Will we see a new generation of designer babies – children whose genetic make-up has been selected according to parental wishes?

The following article imagines a conversation between two prospective parents and their doctor in the not-so-distant future.



Genetically engineered children

– Sit down over here. It won't take but 20 minutes for us to custom-design your fetus.
– You want to custom-design our child, doctor?
– In the summer of 2012, University of Washington researchers made a massive biotechnology breakthrough! Few people talked about it at the time.
– What breakthrough, doctor?
– It involved using a blood sample from a pregnant woman and a saliva specimen from the father to map the DNA of their fetus. It took some time for the procedure to become practical and affordable, but the ability to know a child's complete DNA blueprint eventually gave parents a lot of choices.
– Choices, doctor?
– The press reported that the procedure could allow parents to 'someday prenatally change genes seen as causing diseases or, more startling, pick a child's attributes such as eye color or even intelligence.'
– We can now pick our child's intelligence?
– Why not? We help parents determine the height, weight, eye color and IQ of their children, and that's just for starters.
– Why would parents want to decide all of these things?
– No offense, but you and your wife are a bit chubby. For a price, I can take the fat gene out of your kid's genetic mix and he or she will grow up to be as skinny as a rail.



– But being chubby isn't the end of the world. Winston Churchill was chubby. Orson Welles was. Our parents were. These people did well in life.
– If you say so. But we'll have to do something about your noses. You and your wife have some big honkers. We have a range of celebrity noses you can choose from in our catalog. It will save you a fortune!
– How will custom-designing our child's nose save money?
– We charge a lot less to fix the nose at the gene stage than a plastic surgeon will charge after the baby is grown. Of course, we can avoid your and your wife's obvious imperfections by shopping for a better embryo.
– Use someone else's genes to make our baby?
– It's all the rage! We have a catalog of good-looking Ivy League students who donate their eggs and other genetic specimens for money. We mix and match these parts to create embryos, which we then implant into any mother who can afford our fee.
– Don't you feel that you are trifling with nature, doctor?
– We're simply picking up where nature left off. We're simply refining the baby-making process.
– Perhaps there may be value in correcting medical issues in our child before he or she is born, but this is all so new. We really want to think it through.
– Look, when people try to have kids the old way, all kinds of things can go wrong. Some couples might have a child that has Down syndrome. We prevent such errors from occurring in the lab.
– But, doctor, any parent of a Down syndrome child will tell you that such children are cheerful, loving and blessings from God.
– Whatever. We also eliminate all other imperfections, such as blindness and deafness.
– But Helen Keller was blind and deaf and she did remarkable things. Look, doctor, advances in science are a good thing, but my wife and I really want to think this through. Do we really want the power to manipulate the genetic makeup of our children?
– Hey, most parents want intelligent children who are as attractive as a supermodel. What is wrong with that?
– But if everyone is as beautiful as a supermodel, won't beauty lose some of its meaning, doctor? If parents can custom-create the life of their child, won't life itself lose some of its meaning?
– Meaning? What's all this silly talk about meaning?

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Text by Tom Purcell.

genetically modified /dʒɪ'netɪkli mɒdɪfaɪd/ geenimuunneltu
extract /ekstrækt/ poistaa, vetää pois; ote, uute
fluorescence /fluə'resns/ fluoresenssi, fluoriloiste
jellyfish /dʒelɪfɪʃ/ meduusa
insert into /ɪn'sɜːt ɪntu/ panna, sijoittaa, laittaa sisään
zebrafish /ziːbrəfɪʃ/ seeprakala
glow /gləu/ hohtaa, hehkua; hehku, loiste
engineer /ˌendʒɪ'nɪə/ suunnitella, panna toimeen; insinööri
drug /drʌg/ lääke, huume
spider silk /spaɪdə sɪlk/ hämähäkin seittilanka
tinker with /tɪnkə wɪð/ peukaloida, värkkäillä, näperrellä
arouse /ə'raus/ herättää, kiihottaa, yllyttää
controversy /kɒntrəvɜːsi/ kiistely, kiista, väittely
genetic make-up /dʒɪ'netɪk meɪkʌp/ geneettinen perimä
precise /prɪ'saɪs/ tarkka, täsmällinen
obvious /ɒbvɪəs/ ilmeinen, ilmiselvä
advantage /əd'vɑːntɪdʒ; əd'væntɪdʒ/ etu
eliminate /ɪ'lɪmɪneɪt/ päästä eroon, poistaa
mutation /mjuːteɪʃn/ mutaatio
***give rise to** /gɪv raɪz tu/ aiheuttaa
hereditary /hɪ'redɪtri/ perinnöllinen
disorder /dɪs'ɔːdə/ sairaus, häiriö, epäjärjestys
cystic fibrosis /ˌsɪstɪk faɪ'brəusɪs/ kystinen fibroosi (periytyvä aineenvaihduntasairaus)
blindness /blaɪndnɪs/ sokeus
boon /buːn/ lahja, siunaus
nevertheless /ˌnevəðə'les/ siitä huolimatta, silti, kuitenkin
ethicist /eθɪsɪst/ etiikan harrastaja tai tutkija
modification /ˌmɒdɪfɪ'keɪʃn/ muunnos, muunnelma
procedure /prə'siːdʒə/ toimenpide, menettely
improve /ɪm'pruːv/ parantaa, kohentaa
remove /rɪ'muːv/ poistaa
specific /spə'sɪfɪk/ tietty, erityinen
prospective /prə'spektɪv/ tuleva, mahdollinen
designer baby /dɪ'zaɪnə beɪbi/ vauva, jonka geneettistä perimää on muutettu vanhempien toiveiden mukaan
select /sɪ'lekt/ valita, valikoida, seuloa
according to /ə'kɔːdɪŋ tu/ jonkin mukaan
parental /pə'rentl/ vanhempien
genetically engineered /dʒɪ'netɪkli ˌendʒi'nɪəd/ geenimuunneltu
custom-design /ˌkʌstəm dɪ'zaɪn/ suunnitella yksilöllisesti
fetus /fiːtəs/ sikiö
researcher /rɪ'sɜːtʃə/ tutkija
breakthrough /breɪkθruː/ läpimurto
blood sample /blʌd sɑːmpl, sæmpl/ verinäyte
saliva specimen /sə'laɪvə spesɪmən/ sylkinäyte
DNA blueprint /ˌdiː en 'eɪ bluːprɪnt/ ihmisen solujen sisältämä geneettinen informaatio
prenatally /ˌpriː'neɪtəli/ ennen synnytystä tai syntymää, raskauden aikana
startling /stɑːtlɪŋ/ hätkähdyttävä
attribute /ætrɪbjuːt; ə'trɪbjuːt/ piirre, ominaisuus; laskea jonkun ansioksi tai syyksi
determine /dɪ'tɜːmɪn/ päättää, määrittää
IQ (intelligence quotient) /ˌaɪ 'kjuː; ɪn'telɪdʒəns kwəuʃnt/ älykkyysosamäärä
no offense /nəu ə'fens/ ei millään pahalla
chubby /tʃʌbi/ pullea, pulska
for a price /fər ə praɪs/ sopivaan hintaan
fat gene /fæt dʒiːn/ rasvageeni
skinny as a rail /skɪni æz ə reɪl/ laiha kuin tikku
honker /hɒnkə/ iso nenä
a range of /ə reɪndʒ əv/ valikoima, joukko
celebrity /sɪ'lebrɪti/ kuuluisuus, julkisuuden henkilö
fortune /fɔːtʃn/ omaisuus
fix /fɪks/ korjata, kiinnittää, sopia; pulma
plastic surgeon /plæstɪk sɜːdʒn/ plastiikkakirurgi
imperfection /ˌɪmpə'fekʃn/ epätäydellisyys
embryo /embrɪəu/ alkio
It's all the rage. /ɪts ɔːl ðə reɪdʒ/ Se on viimeistä huutoa.
Ivy League /aɪvi liːg/ kahdeksan Yhdysvaltain itärannikon huippuyliopistoa
donate /dəu'neɪt/ luovuttaa, lahjoittaa
egg /eg/ munasolu, muna
specimen /spesɪmən/ näyte, näytepala
mix and match /mɪks æn mætʃ/ sekoittaa ja yhdistää
implant into /ɪmplɑːnt ɪntu/ istuttaa, kiinnittää
afford /ə'fɔːd/ olla varaa
trifle with /traɪfl wɪð/ leikkiä, leikitellä jollakin
pick up /pɪk ʌp/ jatkaa, nostaa, poimia, ottaa kyytiin
refine /rɪ'faɪn/ jalostaa, kehittää
Down syndrome /daun sɪndrəum/ Downin oireyhtymä
occur /ə'kɜː/ tapahtua, esiintyä, juolahtaa mieleen
blessing /blesɪŋ/ siunaus, onni
deafness /defnɪs/ kuurous
advance /əd'vɑːns, əd'væns/ edistysaskel, edistys; edetä, edistää

8B Answer the questions in English.

1 Why are genetically modified animals mentioned at the beginning of the text?
2 What are some advantages of genetic engineering?
3 Why are some people worried about the genetic engineering of humans?
4 What does the doctor propose to the two prospective parents?
5 What is their response to the doctor's proposals?
6 How does the doctor defend the medical procedure?
7 What does the doctor's final comment suggest?
8 How would you react to the doctor's proposal if you were a prospective parent?

8C Choose the correct alternative.

1 The proposal to require labels on all GM foods has aroused a great deal of ... in the food industry.
a) meaning b) controversy c) control

2 Supporters of GM foods claim that they have many ..., such as making crops more resistant to disease.
a) drugs b) modifications c) advantages

3 New developments in biotechnology give scientists the power to alter the ... of human beings.
a) saliva specimen b) blood sample c) genetic make-up

4 Should scientists be allowed to custom-design children ... parental wishes?
a) according to b) nevertheless c) available to

5 New advances in science might help cure many ... disorders such as cystic fibrosis.
a) affordable b) hereditary c) prenatally

6 One recent scientific ... in the field of biotechnology is the cancer-detecting blood test.
a) disorder b) imperfection c) breakthrough

7 A doctor who performs operations to improve people's appearance is called a plastic ...
a) procedure b) surgeon c) medicine

8 Before the dentist started to ... my wisdom tooth, she gave me a local anesthetic.
a) extract b) determine c) alter

8D In pairs, decide which one of you is A and B. Cover the other half. Take turns translating the sentences into English. Your partner will check your answers.

	A	B
1	Mitä mieltä olet geenitekniikasta?	**How do you feel about / What is your opinion on genetic engineering?**
2	**It has certainly aroused a lot of controversy.**	Se on todellakin herättänyt paljon kiistelyä.
3	Mielestäni geenitekniikalla on ilmeisiä etuja.	**In my opinion genetic engineering has obvious advantages / benefits.**
4	**I think it's wrong to manipulate the genetic make-up of human beings.**	Minusta on väärin muokata ihmisten geneettistä perimää.
5	Mutta se voisi auttaa meitä pääsemään eroon perinnöllisistä sairauksista.	**But it could help us get rid of / eliminate hereditary disorders / diseases.**
6	**True. But think about it, parents could then custom-design their babies prenatally / before they are born.**	Totta. Mutta ajattele, vanhemmat voisivat sitten suunnitella vauvansa yksilöllisesti ennen syntymää.
7	No, aluksi ajatus vaikuttaa hieman hätkähdyttävältä.	**Well, at first the idea does seem / seems a bit startling.**
8	**Isn't it crazy to eliminate all human imperfections?**	Eikö ole hullua poistaa kaikki inhimilliset puutteet?
9	Ehkä olet oikeassa. Plastiikkakirurgienkin täytyy ansaita elanto.	**Maybe you are right. Plastic surgeons have to earn / make a living too.**
10	**And maybe some scientific breakthroughs are just morally unacceptable / not morally acceptable.**	Ja ehkä jotkin tieteelliset läpimurrot eivät vain ole moraalisesti hyväksyttyjä.

8E **Match the words that have almost the same meaning. Then translate them into Finnish.**

1	alter _____	A	decide on _____
2	advance _____	B	feature _____
3	attribute _____	C	disease _____
4	boon _____	D	happen _____
5	determine _____	E	change _____
6	disorder _____	F	remove _____
7	extract _____	G	progress _____
8	medicine _____	H	drug _____
9	occur _____	I	sample _____
10	specimen _____	J	blessing _____

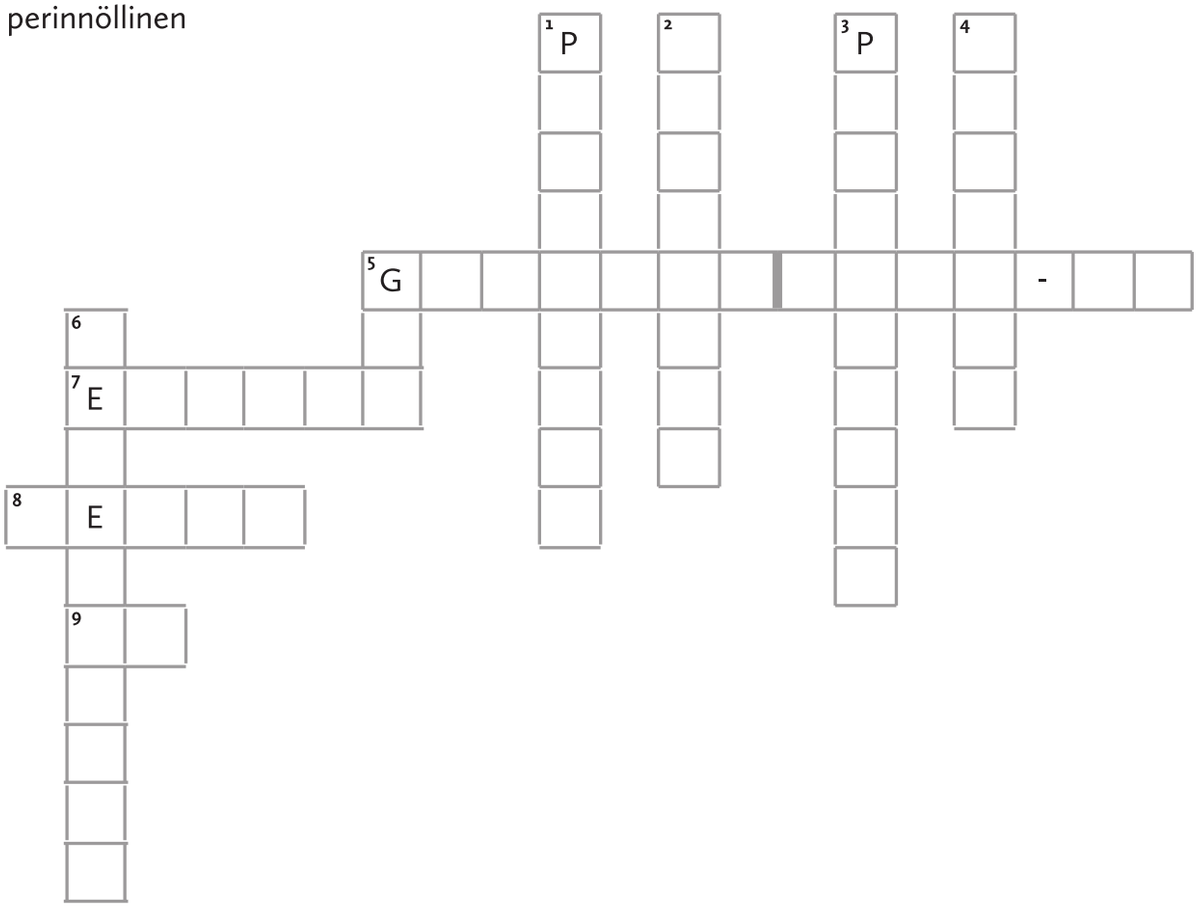
8F Fill in the crossword according to the Finnish clues.

Down

1 toimenpide
2 näyte
3 ennen syntymää
4 kirurgi
5 geenimuunneltu
6 perinnöllinen

Across

5 geneettinen perimä
7 alkio
8 sikiö
9 älykkyysosamäärä



8G You are going to hear a short dialogue where two friends discuss cloning. After listening, answer the questions in Finnish.

1 Mistä uutisesta Ryan puhuu?
2 Miten Tara suhtautuu kloonaukseen?
3 Mitä Tara kertoo eläinten kloonauksesta? Mainitse kaksi asiaa.
4 Mikä on Ryanin mielipide kloonauksesta?

HOW TO

How to use science abbreviations

An abbreviation is a shortened form of a word or phrase. Science often uses abbreviations as it saves time when speaking or writing.

Examples

DNA, deoxyribonucleic acid	*DNA*
GP, general practitioner	*yleislääkäri*
GM, genetically modified	*geenimuunneltu*
GMO, genetically modified organism	*geenimuunneltu organismi*
IV-line, intravenous line	*tiputus*

How to use abbreviations

When writing an expression that is not well known, first write it in full, followed by the abbreviation in brackets. After that simply write the abbreviation on its own.

e.g. The use of renewable natural gas (RNG) is increasing. Many cities have begun to use RNG to fuel municipal vehicles.

8H **Work in pairs or in small groups. Choose one topic about genetic engineering for a short debate. Your teacher will give you instructions for debate.**

Motions

1 Parents should be allowed to genetically engineer the kind of baby they want.
2 We should ban the development of genetically modified organisms.
3 A sample of DNA should be taken from every citizen to help police with their work.
4 Employers should be able to see applicants' genetic profiles before offering them a job.

8I **Choose either task A, B or C and write about 150–250 words.**

A If you could improve an ability such as singing or running by modifying your genes, what ability would you choose?

B Scientific and technological progress is always good.

C Genetic testing: A key to a better world?
It has been suggested that genetic testing should be compulsory for all couples before they have children to identify harmful gene mutations that can be passed on to their children. What is your opinion?

8J **Science report. First do some research and then write a science report on one of following topics. See the online *How to write* section for help.**

- The pros and cons of GM foods
- The medical uses of genetic engineering
- The drawbacks and benefits of animal cloning
- The basics of cloning: history, science and scientists
- The risks and benefits of genetic engineering in human embryos

UNIT 3

High-tech lives

Topic 9

Inventive women

Any problem can be solved using the materials in the room.

(Dr E. H. Land, American scientist and inventor)

9A **What modern conveniences could you not live without? Work in pairs. Take turns to answer the following questions.**

- If you could keep only one modern appliance in the house (apart from your phone and computer) what would it be?
- New gadgets: What could/should still be invented?
- In what way has technology changed since your parents' day? Talk about school, home, shopping and so on. Do you think life is better now?

Gran, what games did you have on your phone when you were a child?

Personal dictionary

9B **Read text 9. Find the words below in the text and underline them.**

- First guess the meaning of the words, then look them up in the vocabulary app if necessary and write them down on p. 103.
- Choose 3–5 extra words and mark them, too.
- Try making sentences with some of the words.

1 immerse
2 contraption
3 durable
4 obtain
5 heirloom
6 rope in
7 tank
8 acquire

9C **Read text 9. Answer questions 1, 2, 5–7. In questions 3 and 4, choose the correct alternative.**

Topic 9 Key text

Mothers of invention

Consider all the things we take for granted in our everyday lives. Turn a tap, water comes out. Flip a switch, a light comes on. Board a plane, get on your bike, microwave a pizza, buy some milk... every single one of those actions were made possible by curious scientists and inventors pushing the frontiers of what was thought possible at the time. The online magazine, *InventThis*, celebrated Women Inventors' Day on April 2. Read a selection of posted entries below.

InventThis

Home | Inventors | Design | Medicine | Culture | Tech | Retail

Inventors – ladies who rock

Which female inventors made a difference? Write to us.

Morning cuppa
Doona Corbin, March 2

Melitta Bentz (1873–1950)

Next time you brew a fresh pot of coffee, say a silent thank you to Melitta Bentz for making your life easier by developing the first paper filters for coffee. Coffee beans have been made into beverages since at least the eleventh century, but a housewife from Dresden updated coffee making for the modern world.

In the 1900s, many people in Europe brewed coffee daily. At the time, the usual method was to tie up the coffee grounds in a small cloth bag and immerse the bag into a pot of boiling water, resulting in a gritty drink.

Like many of those so-simple-it's-brilliant innovations, Melitta's invention was born out of exasperation. To get rid of the irritating coffee grounds in the cup, she devised a simple and easily disposable filtration system by laying a piece of blotting paper from her son's schoolbook over the perforated bottom of a brass pot, and poured the coffee over the two-part contraption. The result? The coffee tasted significantly more aromatic and there were no gritty bits in the bottom of the cup.

She filed a patent application, registering her own company in 1908. In the 1930s, the filter's original design was changed, giving us the unmistakable triangular-folded paper filter we still use today. Thanks Melitta!

1 Mikä oli yleinen tapa tehdä kahvia 1900-luvun alussa?
2 Mikä inspiroi Melittaa suunnittelemaan suodatinpaperia?

Material girl
Jon Sheen, March 19
1 Comment

Stephanie Kwolek (1923–2014)

Stephanie Kwolek was an organic chemist, best known for inventing an unusually tough, lightweight new fiber called Kevlar in 1965. It's a particularly hard, durable and heat-resistant kind of plastic with a very high strength-to-weight ratio. Du Pont, the company where Kwolek worked, famously claimed that it was "five times stronger than steel on an equal weight basis". It has hundreds of applications, and we find it in everything from space capsules to skis, oven gloves and helmets, fiber-optic cables and suspension bridges, to name but a few. Most notably, Kevlar is used in the manufacturing of bulletproof vests and body armor for soldiers. Originally, Stephanie wanted to become a doctor, and she took the job as a textile chemist at DuPont with the intention of funding her medical studies. But the temporary position became a permanent one, and she never obtained her medical degree. However, her invention has probably saved more lives than she ever would have done as a doctor.

3 What is true according to the text?
   a) Kevlar is durable and the same weight as steel.
   b) Kevlar is used in many different ways.
   c) Stephanie Kwolek worked as a chemist and as a doctor.

High visibility
LindaJ, March 27
1 Comment

Mary Anderson (1866–1953)

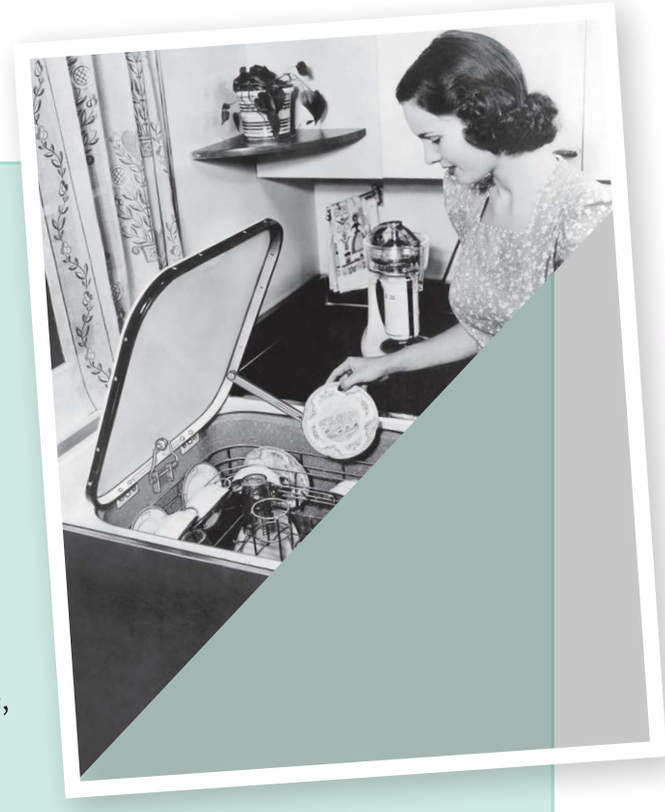
At a time when cars were relatively rare, a quiet woman from Alabama was not a likely candidate to invent the windshield wiper – especially considering the fact that her innovation predated Henry Ford's first mass-produced cars. But invent them she did. Visiting New York for the first time in the winter of 1902, she noticed the difficulties the tram driver had in keeping the windshield clear of sleet. Back in Alabama, she drew up a practical solution: a design for a windshield blade that was connected to the interior of the car, allowing the driver to operate the windshield wiper from inside the vehicle. She called it a "window cleaning device," and received the patent for her innovation in 1903. However, Mary's invention was ahead of its time, and nobody was interested in investing in her idea. Ten years later, however, thousands of Americans owned a car with her invention busily cleaning their windshields. Unfortunately, by this time her patent had expired and she made no money from her innovation at all.

4 Mary Anderson
   a) thought of developing a 'window cleaning device' while driving to New York.
   b) failed to patent her innovation.
   c) was ahead of the future car manufacturers with her innovation.

Handle with care

August Beavers, March 30

2 Comments



Josephine Cochrane (1839–1913)

The story of the dishwasher reads like a weird fairytale. Once there was a wealthy socialite who loved to entertain. She has servants to do the dishes after her fancy dinners, but unfortunately they are a little clumsy, chipping and breaking her expensive heirloom china. Deciding that a machine would be more careful, she designs the world's first dishwasher in the shed behind her house in Shelbyville, Illinois. Knowing very little about the nuts and bolts of a working machine, she ropes in a mechanic called George Butters to assist her. Meanwhile, Josephine Cochrane's husband dies, and faced with massive debt, her innovative washing machine becomes her meal ticket. Targeted at housewives, the dishwasher initially tanked, since women did not like spending money on something that they could do for free. Josephine then concentrated on commercial concerns, like hotels and restaurants, highlighting the fact that her innovative machine could do the job they were paying dozens of employees to do. In time, however, more households acquired the device as greater numbers of women were entering the workforce, which brings us to your kitchen. Where the dishwasher is probably humming along while you are reading this article. Raise your (clean) glass to Josephine!

5 Mikä inspiroi Josephinea suunnittelemaan tiskikoneen?

6 Miksi tiskikone ei aluksi ollut menestys?

7 Miten Josephine sai keksintönsä tuottamaan?

***take for granted** /teɪk fə grɑːntɪd, græntɪd/ pitää itsestään selvänä
tap /tæp/ hana, vesihana, tappi; naputtaa
flip /flɪp/ näpsäyttää, kääntää, heittää; heitto, voltti
switch /swɪtʃ/ katkaisin, kytkin; vaihtaa, kytkeä
board /bɔːd/ nousta, astua; lauta, kartonki
inventor /ɪn'ventə/ keksijä
frontier /frʌntɪə, frʌn'tɪə/ raja, raja-alue
retail /riːteɪl, riː'teɪl/ vähittäismyynti, vähittäiskauppa; harjoittaa vähittäiskauppaa, levittää
cuppa /kʌpə/ kahvikuppi (puhek.)
brew /bruː/ keittää, hautua, valmistaa, panna; keitos
pot /pɒt/ pannu, purkki; purkittaa
filter /fɪltə/ suodatin, filtteri; suodattaa, siivilöidä
bean /biːn/ papu
beverage /bevərɪdʒ/ juoma
coffee grounds /kɒfi graundz/ kahvi, kahvinpurut
cloth /klɒθ/ kangas, liina, vaate
immerse /ɪ'mɜːs/

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gritty /grɪti/ rakeinen, pölyinen, hiekkainen
innovation /ɪnə'veɪʃn/ innovaatio, uudistus, uutuus
invention /ɪn'venʃn/ keksintö
exasperation /ɪgˌzɑːspə'reɪʃn, ɪgzæ'spə'reɪʃn/ ärsytys
irritating /ɪrɪteɪtɪŋ/ ärsyttävä, harmittava, rasittava
devise /dɪ'vaɪz/ keksiä, suunnitella
disposable /dɪ'spəuzəbl/ käytettävissä, kertakäyttöinen
filtration /fɪl'treɪʃn/ suodatus
blotting paper /blɒtɪŋ peɪpə/ imupaperi
perforated /pɜːfəreɪtɪd/ rei'itetty
brass /brɑːs, bræs/ messinki, vaskipuhaltimet
contraption /kən'træpʃn/

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aromatic /ˌærə'mætɪk/ aromaattinen, aromikas
file a patent /faɪl ə pætnt, peɪtnt/ hakea patenttia
application /ˌæplɪ'keɪʃn/ hakemus, sovellus, menetelmä, levittäminen
unmistakable /ˌʌnmɪ'steɪkbl/ selvä
triangular /traɪ'æŋgjulə/ kolmion muotoinen, kolmikulmainen
organic /ɔː'gænɪk/ eloperäinen, orgaaninen
chemist /kemɪst/ kemisti, apteekki (BrE)
fiber (AmE), **fibre** (BrE) /faɪbə(r)/ kuitu, säie
kevlar /kevlə/ kevlari
durable /djuərəbl/

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heat-resistant /ˌhiːt rɪ'zɪstənt/ lämmönkestävä
ratio /reɪʃiəu/ suhde, suhdeluku
capsule /kæpsjuːl, kæpsl/ kapseli
oven glove /'ʌvn glʌv/ uunikinnas
helmet /helmɪt/ kypärä
fiber-optic /ˌfaɪbə(r) 'ɒptɪk/ valokuitu
cable /keɪbl/ kaapeli, sähke
suspension bridge /sə'spenʃn brɪdʒ/ riippusilta
bulletproof /bulɪtpruːf/ luodinkestävä
vest /vest/ liivi
body armor /bɒdi ɑːmə(r)/ suojaliivi, luotiliivi
fund /fʌnd/ rahoittaa; kassa, rahasto
obtain /əb'teɪn/

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medical degree /medɪkl dɪ'griː/ tutkinto lääketieteessä
windshield wiper /wɪndʃiːld waɪpə/ tuulilasinpyyhkijä
predate /ˌpriː'deɪt/ edeltää, varhentaa
mass-produced /ˌmæs prə'djuːsd, prə'duːsd/ massatuotettu
tram /træm/ raitiovaunu
sleet /sliːt/ räntä
solution /sə'luːʃn/ ratkaisu, liuos
windshield blade /wɪndʃiːld bleɪd/ tuulilasinpyyhkijän sulka
interior /ɪn'tɪərɪə/ sisäinen
device /dɪ'vaɪs/ laite, suunnitelma, juoni
invest in /ɪn'vest ɪn/ sijoittaa, satsata
expire /ɪk'spaɪə/ päättyä, mennä umpeen
dishwasher /'dɪʃˌwɒʃə/ astianpesukone
weird /wɪəd/ kummallinen, outo
fairytale /feərɪteɪl/ satu
socialite /səuʃəlaɪt/ seurapiirihenkilö, silmäätekevä
entertain /ˌentə'teɪn/ kestitä, viihdyttää, huvittaa

→

clumsy /klʌmzi/ kömpelö
chip /tʃɪp/ kolhu, sirpale, nirhama, pala
heirloom /eəluːm/

china /tʃaɪnə/ posliini
shed /ʃed/ vaja, liiteri, aitta; karistaa
nut /nʌt/ mutteri, pähkinä, hullu
bolt /bəult/ pultti; pultata
rope in /rəup ɪn/

debt /det/ velka
meal /miːl/ ruoka, ateria

target /tɑːgɪt/ suunnata, osoittaa; kohde, maali
initially /ɪˈnɪʃəli/ alkuaan, alun perin, aluksi
tank /tæŋk/

commercial concern /kəˈmɜːʃl kənˈsɜːn/ kaupallinen yritys
highlight /haɪlaɪt/ korostaa, painottaa, tähdentää; korostus, kohokohta, raita
acquire /əˈkwaɪə/

workforce /wɜːkfɔːs/ työvoima, henkilöstö
hum /hʌm/ hymistä, hyristä

Phrase hunt

9D Find the following expressions in the text.

1 pitää itsestäänselvänä _____
2 päästäkseen eroon _____
3 mainittakoon vain muutama _____
4 ajatuksena rahoittaa opintonsa _____
5 ottaen huomioon _____
6 talvella 1902 _____
7 Kuitenkin kymmenen vuotta myöhemmin _____
8 Päättäen että _____
9 naiset tulivat työelämään _____
10 kun luet tätä artikkelia _____

9E Choose and underline the correct option. All the expressions and words are from exercise 9D.

Once they have been around for a while, most inventions are **1 taken / given / invented** for granted. Take the bikini, for example. **2 During / While / After** you are reading this paragraph, somewhere in the world people are lying on beaches, enjoying the sunshine. Many of them will be wearing bikinis. **3 Think / Consider / Considering** how common it is nowadays, it is hard to imagine that the bikini was once banned in some European countries. The Vatican thought it was evil, and suggested that young Italians who had bought the skimpy swimsuit **4 get over it /get rid of it / go after it**.

Who invented it? **5 In summer / In the summer / In the summer of** 1946 a mechnical engineer named Louis Rèard launched a new swimsuit, named after the Bikini Atoll which was in the news at the time. Professional French models refused to wear it. Rèard believed in his invention **6 however / application / relatively**, and was sure that it would be a hit. Eventually an exotic dancer at the Casino de Paris agreed to model the bikini at a popular swimming pool in Paris. It was an instant hit. Soon famous film stars like Bridgette Bardot, Marilyn Monroe and Lana Turner, **7 to call a few / to name but a few / naming a few**, started wearing bikinis too. Today this invention has become the world's most popular beachwear.

Early bikinis make a splash.

9F In pairs, decide which one of you is A and B. Cover the other half. Take turns translating the sentences into English.

	A	B
1	Pidätkö itsestään selvyytenä, että teillä on kotona monia kodinkoneita?	**Do you take it for granted that you have many household appliances at home?**
2	**Of course not! Every morning I thank the inventor who invented the coffee maker and coffee filter.**	En tietenkään! Joka aamu kiitän sitä keksijää, joka keksi kahvinkeittimen ja suodatinpussin.
3	Juuri niin. Tiesitkö, että keksijän nimi oli Melitta?	**Exactly. Did you know that the inventor's name was Melitta?**
4	**Really? She must have filed / probably filed a patent for her invention?**	Ihanko totta? Hän haki varmasti keksinnölleen patentin?
5	Kyllä. Tiedän pari muutakin naiskeksijää: toinen keksi tuulilasinpyyhkimet autoon ja toinen astianpesukoneen.	**Yes. I know a couple of other female inventors: one invented the windshield wipers and the other the dishwasher.**
6	**I'm sure dishwashers were/became popular right away. Doing the dishes by hand is hard work.**	Olen varma, että astianpesukoneista tuli heti suosittuja. Käsin tiskaaminen on kovaa työtä.
7	Itse asiassa astianpesukone ei ollut ollenkaan suosittu aluksi. Kotirouvat eivät halunneet käyttää rahaa johonkin, minkä pystyivät tekemään itse ilmaiseksi.	**In fact, the dishwasher wasn't very popular at all to begin with. Housewives didn't want to spend money on something they could do for free.**
8	**In the end dishwashers became a big hit. Shall we go back to our own project and continue assembling the cabinet/ cupboard in the shed?**	Loppujen lopuksi astianpesukoneet olivat iso hitti. Menemmekö me takaisin meidän oman projektimme pariin vajassa ja jatkamaan kaapin kasaamista?

9G Translate sentences 1–3 into English and sentences 4–6 into Finnish.

1 Ovatko kahvinsuodattimet tehneet elämästäsi helpompaa aamuisin?
2 Onko sinun tarkoitus rahoittaa yliopisto-opintosi itse?
3 Älä käytä rahaa mihinkään, minkä voit saada ilmaiseksi.

4 Targeted at housewives, the dishwasher was not successful to begin with.
5 This design, allowing the driver to operate the windshield wiper from inside the vehicle, was a great success right away.
6 Deciding that a machine would be more effective, Josephine designed the world's first dishwasher.

9H Opposites attract. Find and match the antonyms. All the words in column B are from the section on Melitta Bentz in text 9.

A		B	
1	stale _____	A	disposable
2	smooth _____	B	fresh
3	indispensable _____	C	perforated
4	somewhat _____	D	gritty
5	solid _____	E	significantly

Write three to five sentences using the words from column B.

Example
Do you call that gritty mix a smoothie?

9I **Choose the correct preposition. All prepositions are from text 9. Choose the correct answer for questions 2–6 from the box.**

1 Many of the things we take **for** / **–** / **as** granted today, like the safety pin or mayonnaise, started with somebody having a wild idea that eventually resulted **at** / **in** / **on** a product we can use. Try to answer the following questions **at** / **about** / **of** inventors and their inventions.

peanuts ☐ Hedy Lamarr ☐ bubble gum ☐ Nikola Tesla ☐ bubble wrap ☐

2 This invention was originally pink, because it was the only dye the inventor had on hand **in** / **–** / **at** the time.
3 Which product did George Washington Carver use **at** / **in** / **with** the manufacturing **of** / **–** / **in** products like dyes, plastics, cosmetics and cooking oil, for example?
4 Two inventors drew **in** / **on** / **up** a plan for three-dimensional plastic wallpaper, which was a failure. But their design led to another often used product. What is the product?
5 Best known **as** / **for** / **at** her acting, and once promoted as "the world's most beautiful woman" by Hollywood, she also developed a radio guidance system for Allied torpedoes. Who was she?
6 This inventor was ahead **on** / **of** / **after** his time, but he made hardly any money **from** / **at** / **in** his many brilliant inventions. After his death, the FBI confiscated all his designs. We don't know if they got rid **of** / **–** / **on** his plans, or whether they developed them.

9J **Work in pairs. Choose one or two of the objects below. Think of three alternative ways to use each object. Use your imagination.**

9K **Work in pairs. Think of an object. Describe it to your partner without revealing the function of the object. Your partner tries to guess what you are describing. Swap roles. Continue playing until your teacher tells you the time is up.**

Example
It is made of cloth. They hang in front of the windows. They can be patterned...
Answer: a curtain

HOW TO

How to describe size

The following words will help you to describe size.

Adjective	Noun
high e.g. The box is a 50cm high.	**height** e.g. The height of the box is 50cm.
long e.g. The box is a 90cm long.	**length** e.g. The length of the box is 90cm.
wide e.g. The box is a 60cm wide.	**width** e.g. The width of the box is 60cm.

Pronunciation tip: height rhymes with light
weight rhymes with late

N.B. *Broad* and *breadth* mean the same as *wide* and *width*.

9L Who was the famous bag lady? Listen to the profile of an inventor and answer the questions.

1 Mikä seikka teki paperikassista vahvan? Miksi?
2 Miten Margaret E. Knightin keksintö muutti paperikassien valmistusta?
3 Miten Margaret onnistui todistamaan oikeudelle, että suunnitelma oli hänen?

9M Invent and present. Think of something that you would like to invent. It could be something practical, or something totally wild. Draw a picture of your innovation or put together a collage from pictures to help your audience visualise your idea.

Make a video at home where you present your idea or do it in front of a live audience at school.

Answer some or all of the following questions in your presentation.

- WHY did you create it?
- WHAT is the purpose of your invention?
- HOW is it used?
- HOW does it make your life easier or better?

When you are explaining something complicated to somebody, for example when you present a new invention, you may want to check that the other person has understood correctly.

Here are some phrases you can use:

Are you with me?
Are you still with me?
Is that clear?
OK so far?
Do you see what I mean?

Topic 10

Sweet enough!

Eat less sugar! You're sweet enough.
(Anonymous)

10A **Sugar content. Work with a partner. Take a look at the pictures. Put the pictures in order of how much sugar each food item contains.**

☐ ☐ ☐ ☐ ☐

☐ ☐ ☐ ☐

- Were there any surprises?
- How often do you eat these food items?
- Are there any you try to avoid? Why?

Personal dictionary

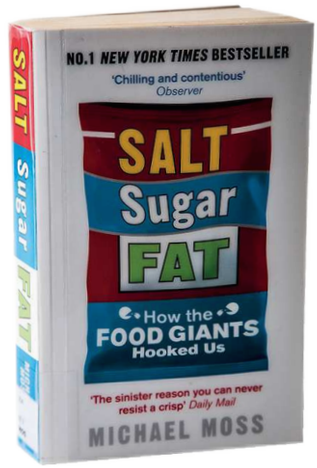
10B **Read text 10. Find the words below in the text and underline them.**

- First guess the meaning of the words, then look them up in the vocabulary app if necessary and write them down on p. 115.
- Choose 3–5 extra words and mark them, too.
- Try making sentences with some of the words.

1 craving
2 innate
3 dispute
4 sour
5 zeal
6 intricately
7 infusion
8 tolerance

Topic 10 Key text

Salt Sugar Fat



Sugar works in mysterious ways. Research done with rats shows that if you continuously feed them sweet cookies, for instance, they don't stop eating. They stuff themselves. With other types of food, the rats would eat until they have had enough, whereas with sugary foods their craving somehow overrides the biological brakes that tell them "Stop! Enough already."

In 1975, scientist Lawrence Green researched children's taste for sugary products. Green's hypothesis at the time was that children's craving for sugar was not innate, but rather the result of the massive amounts of sugar being added to processed foods. In other words, the sweeter the industry made its food and drinks, the sweeter the kids liked their food to be. It was a classic case of learned behaviour.

Some scientists now claim that our craving for sugary products is a combination of an innate trait and learned behaviour, while others say that our desire for sugar is inborn. But the role of sugar in processed food is beyond dispute.

Investigative reporter Michael Moss spent 3 ½ years researching how major food companies manipulate processed food to make us eat more. Read what he has to say about sugar.

The first thing to know about sugar is this: Our bodies are hard-wired for sweets. Forget what we learned in school from that old diagram called the tongue map, the one that says our five main tastes are detected by five distinct parts of the tongue. That the back has a big zone for blasts of bitter, the sides grab the sour and the salty, and the tip of the tongue has that one single spot for sweet. The tongue map is wrong. As researches would discover in the 1970s, its creators misinterpreted the work of a German graduate student that was published in 1901; his experiments showed only that we might taste a little more sweetness on the tip of the tongue. In truth, the entire mouth goes crazy for sugar, including the upper reaches known as the palate. There are special receptors for sweetness in every one of the mouth's ten thousand taste buds, and they are all hooked up, one way or another, to the parts of the brain known as the pleasure zones, where we get rewarded for stoking our bodies with energy. But our zeal doesn't stop there. Scientists are now finding taste receptors that light up for sugar all the way down our esophagus to our stomach and pancreas, and they appear to be intricately tied to our appetites.

The second thing to know about sugar: food manufacturers are well aware of the tongue map folly, along with a whole lot more about why we crave sweets. They have on staff cadres of scientists who specialize in the senses, and the companies use their knowledge to put sugar to work for them in countless ways. Sugar not only makes the taste of food and drink irresistible. The industry has learned that it can also be used to pull off a string of manufacturing miracles, from donuts that fry up bigger to bread that won't go stale to cereal that is toasty-brown and fluffy. All this has made sugar a go-to ingredient in processed foods. On average, we consume 71 pounds of caloric sweeteners each year. That's 22 teaspoons of sugar, per person, per day. The amount is almost equally split three ways, with sugar derived from sugar cane, sugar beets, and the group of corn sweeteners that includes high-fructose corn syrup (with a little honey and syrup thrown into the mix.)

• • •

Sweet drinks are particularly problematic. Researcher Karen Teff has found signs that sweet drinks may be a Trojan horse when it comes to making people gain weight. Our bodies might not be able to identify the calories in sweet liquids as well as they can in solid foods. Such a blindness to soda and other caloric drinks would circumvent the natural controls that the body has in place to prevent excessive weight gain.

In 2006, she conducted a study in which people received an infusion of glucose, and then she watched their response. The test lasted only forty-eight hours, but the results were striking: The subjects did not cut back on their eating at all. They just took in those extra glucose calories like they were invisible. "If these liquids do not activate the nervous system, they may not be recognized," Teff said.

More experimentation would need to be done for this notion to gain currency among nutritionists, but Teff is not shy about holding the food industry's feet to the fire. When it comes to sugar in drinks or solid food, their practice is to add more first and study later – if at all. "I'm still shocked at what goes on in this country," she told me. "Where every single food has some sweetened component that wasn't normally supposed to be sweetened. Honey wheat bread, honey mustard. Foods that were associated with non-sweet or that had slightly bitter components have now been made sweeter. There is absolutely no tolerance now for foods that are not sweet."

• • •

In sum, a scarcely regulated food industry can, and does, use scientists to engineer its products by loading them with sugar, salt and fat, bypassing the neurological signals that would otherwise prompt people to stop eating. Researchers at the University of California, San Francisco, suggested that sugar is as toxic to the liver as alcohol, and that overconsumption is at the root of growing public health problems. They commented that "this is an industry that has billion-dollar budgets for bombarding both adults and children with advertising, yet when confronted with the current rise in obesity, they blame the customers for eating too much of the products they sell. Go figure."

Excerpt(s) from SALT SUGAR FAT: HOW THE FOOD GIANTS HOOKED US by Michael Moss, © 2013 by Michael Moss. Used by permission of Random House, an imprint and division of Penguin Random House LLC. All rights reserved.

research /rɪ'sɜːtʃ, riːsɜːtʃ/ tutkimus; tutkia, tehdä tutkimusta
continuously /kən'tɪnjuəsli/ jatkuvasti, tauotta
stuff oneself /stʌf wan'self/ ahtaa itsensä täyteen
craving /kreɪvɪŋ/

***override** /ˌəuvə'raɪd/ syrjäyttää, ohittaa
biological /ˌbaɪə'lɒdʒɪkl/ biologinen
brake /breɪk/ jarru; jarruttaa
sugary /ʃugəri/ sokerinen
product /prɒdʌkt/ tuote, valmiste, tavara
hypothesis, hypotheses /haɪ'pɒθɪsɪs, haɪ'pɒθɪsiːz/ olettamus, hypoteesi
innate /ɪ'neɪt/

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processed food /prɒsest fuːd/ eines, valmisruoka
industry /ɪndəstri/ teollisuus, ala, toimiala, teollisuudenala
learned behaviour /lɜːnd bɪ'heɪvɪə/ ehdollistettu oppiminen, opittu käyttäytyminen
claim /kleɪm/ väittää, lunastaa, vaatia; vaatimus, väite
trait /treɪt/ piirre, luonteenpiirre
inborn /ˌɪn'bɔːn/ synnynnäinen
dispute /dɪ'spjuːt/

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investigative reporter /ɪn'vestɪgətɪv rɪ'pɔːtə/ tutkiva journalisti
hard-wired /ˌhɑːd 'waɪəd/ sisäänrakennettu
diagram /daɪəgræm/ diagrammi, graafinen esitys, kaavio
tongue /tʌŋ/ kieli
detect /dɪ'tekt/ havaita, huomata, paljastaa
distinct /dɪ'stɪŋkt/ selvästi erotettava, erillinen, eri
zone /zəun/ vyöhyke, alue
blast /blɑːst, blæst/ räjähdys; räjähtää, räjäyttää
bitter /bɪtə/ kitkerä, karvas, katkera
grab /græb/ siepata, napata, tarrata
sour /sauə/

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tip /tɪp/ kärki, vihje, neuvo; antaa vinkki
spot /spɒt/ paikka, pilkku, tahra
creator /krɪ'eɪtə/ luoja
misinterpret /ˌmɪsɪn'tɜːprɪt/ tulkita väärin, selittää väärin
graduate student /grædʒuət stjuːdnt, stuːdnt/ yliopisto-opiskelija
experiment /ɪk'sperɪmənt/ koe, kokeilu; tehdä koe, kokeilla
upper reaches /ʌpə riːtʃiz/ yläosa
palate /pælɪt/ kitalaki, suulaksi, makuaisti
receptor /rɪ'septə/ reseptori, vastaanotin
taste bud /teɪst bʌd/ makunystyrä
pleasure zone /pleʒə zəun/ mielihyväkeskus
reward /rɪ'wɔːd/ palkita: palkinto, palkkio, löytöpalkkio
stoke /stəuk/ lämmittää, kohentaa
zeal /ziːl/

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light up /laɪt ʌp/ sytyttää
esophagus /i'sɒfəgəs/ ruokatorvi
pancreas /pæŋkriəs/ haima
intricately /ɪntrɪkɪtli/

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appetite /æpɪtaɪt/ ruokahalu
manufacturer /ˌmænju'fæktʃərə/ valmistaja, tuottaja
folly /fɒli/ hömpötys, typeryys, hulluus, mielettömyys
cadres of /kɑːdəz, kɑːdreɪz əv/ paljon, joukottain
sense /sens/ aisti; tuntea, aistia
countless /kauntlɪs/ lukematon, rajaton, määrätön
irresistible /ˌɪrɪ'zɪstɪbl/ vastustamaton
pull off /pul ɒf/ onnistua tekemään
string /strɪŋ/ naru, nyöri, lanka
donuts (AmE), **doughnut** (BrE) /dəunʌt/ donitsi
stale /steɪl/ vanhentunut, väljähtänyt, ummehtunut, kulunut
cereal /sɪərɪəl/ murot, vilja, viljanjyvä
toasty-brown /ˌtəusti 'braun/ paahdetun ruskea
fluffy /flʌfi/ kuohkea, pehmeä, pöyheä, pörröinen
go-to /ˌgəu 'tu/ lisättävä
ingredient /in'griːdɪənt/ ainesosa, aines, valmistusaine
on average /ɒn ævərɪdʒ/ keskimäärin, tyypillisesti

→

consume /kən'sjuːm, kən'suːm/ syödä, kuluttaa, käyttää
caloric sweetener /kə'lɔrɪk swiːtənə/ kaloreja sisältävä makeutusaine
split /splɪt/ jakaa, jakautua, haljeta
derive /dɪ'raɪv/ johtaa, johtua
sugar cane /ʃugə keɪn/ sokeriruoko
sugar beet /ʃugə biːt/ sokerijuurikas
corn sweetener /kɔːn swiːtənə/ maissista tehty makeutusaine
high-fructose /ˌhaɪ 'frʌktəus/ paljon hedelmäsokeria sisältävä
corn syrup /kɔːn sɪrəp/ maissisiirappi
mix /mɪks/ sekoitus, seos: sekoittaa, yhdistää
sign /saɪn/ merkki, ele; allekirjoittaa, viittoa
Trojan horse /ˌtrəudʒən 'hɔːs/ troijalainen hevonen
gain weight /geɪn weɪt/ lihoa
identify /aɪ'dentɪfaɪ/ tunnistaa, havaita, samastaa
liquid /lɪkwɪd/ nestemäinen, neste-, kirkas
solid /sɒlɪd/ kiinteä, täysi, sakea, järkevä
blindness /blaɪndnɪs/ sokeus
soda /səudə/ virvoitusjuoma (AmE), kivennäisvesi, sooda=natriumkarbonaatti
circumvent /ˌsɜkəm'vent/ kiertää
prevent /prɪ'vent/ estää, ehkäistä
excessive /ɪk'sesɪv/ liiallinen, yletön, ylimääräinen
conduct a study /kən'dʌkt ə stʌdi/ tehdä tutkimus
infusion /ɪn'fjuːʒn/

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glucose /gluːkəuz, gluːkəus/ glukoosi, rypälesokeri
response /rɪ'spɒns/ vastaus, reaktio
striking /straɪkɪŋ/ silmiinpistävä, iskevä
***cut back** /kʌt bæk/ vähentää
invisible /ɪn'vɪzəbl/ näkymätön
activate /æktɪveɪt/ aktivoida, käynnistää
nervous system /nɜːvəs sɪstəm/ hermosto, hermojärjestelmä
experimentation /ɪkˌsperɪmen'teɪʃn/ kokeilu
gain currency /geɪn kʌrənsi/ tulla hyväksytyksi, saada hyväksyntää
nutritionist /njuː'trɪʃənɪst, nuː'trɪʃənɪst/ ravitsemusasiantuntija
***hold somebody's feet to the fire** /həuld sʌmbədis fiːt tu ðə faɪə/ saada vastuuseen
component /kəm'pəunənt/ ainesosa, osa, rakenneosa
wheat /wiːt/ vehnä
mustard /mʌstəd/ sinappi, sinapinkeltainen
associate with /ə'səuʃɪeɪt, ə'səusɪeɪt wɪð/ yhdistää, yhdistyä; työtoveri, liikekumppani
tolerance /tɒlərns/

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scarcely /skeəsli/ niukasti, tuskin, hädin tuskin
regulate /regjuleɪt/ säännellä, säätää, valvoa
engineer /ˌendʒɪ'nɪə/ suunnitella, toteuttaa; insinööri, suunnittelija
load /ləud/ lastata, kuormata
bypass /baɪpɑːs, baɪpæs/ kiertää, ohittaa, sivuuttaa
neurological /ˌnjuərə'lɒdʒɪkl/ neurologinen
signal /sɪgnl/ merkki, signaali; antaa merkki, viestittää
prompt /prɒmpt/ kehottaa, neuvoa; pikainen, ripeä, kehote
suggest /sə'dʒest, səg'dʒest/ antaa ymmärtää, ehdottaa, vihjailla
toxic /tɒksɪk/ myrkyllinen
liver /lɪvə/ maksa
overconsumption /ˌəuvəkən'sʌmpʃn/ ylensyönti
at the root of /æt ðə ruːt əv/ perimmäinen syy
public health /pʌblɪk helθ/ kansanterveys
budget /bʌdʒɪt/ määräraha, budjetti; budjetoida
bombard /bɒm'bɑːd/ pommittaa
confront with /kən'frʌnt wɪð/ kohdata, tavata, haastaa
current /kʌrənt/ nykyinen
obesity /əu'biːsɪti/ lihavuus, liikalihavuus
Go figure. /gəu fɪgə, fɪgjə/ Ota siitä sitten selvää.

10C Choose the correct alternative.

(lines 1–20)

1 What is true according to the introduction?
   a) Sugar in foods makes you feel less hungry.
   b) Scientists don't agree about whether our craving for sugar is innate or learned behaviour.
   c) Rats have an innate ability to control their consumption of sugar.

(lines 21–37)

2 What is *not* true about taste?
   a) The tongue map is wrong.
   b) Your whole mouth is responsive to the taste of sweet things.
   c) Taste buds are concentrated on the tip of the tongue.

3 What is true according to the paragraph?
   a) The esophagus sends a message to our brain that the stomach is full.
   b) Taste receptors receive information from all over the body.
   c) There is a connection between the taste buds and the brain.

(lines 38–50)

4 Why is sugar a 'go-to' ingredient in the processed food industry?
   a) It makes donuts fluffy and gives them an attractive brown colour.
   b) The manufacturers can use three different types of sugars.
   c) It makes food and drink taste better and it makes bread last longer.

(lines 51–81)

5 What does Karen Teff say about sugar and the food industry?
   a) Solid foods contain as many calories as sweet drinks.
   b) In the food industry business, the natural tastes of many foods have almost disappeared.
   c) The food industry carefully considers the negative effects of sugar before adding it to foods.

6 What is the main point of the final paragraph?
   a) Sugar is just like alcohol.
   b) People should just say no to sugary products.
   c) The food industry uses science to manipulate food, which leads to overconsumption.

10D Match the beginning of the sentence with the end. Then translate the sentences into Finnish.

1 Research done with rats shows that if you feed them sweet cookies, for instance, _____
2 Lawrence Green's hypothesis was that children's craving for sugar was not innate, _____
3 Investigative reporter Michael Moss spent 3½ years researching _____
4 There are special receptors for sweetness in every one of the mouth's ten thousand taste buds, _____
5 Food manufacturers have on staff cadres of scientists who specialize in the senses, _____
6 The amount of sugar we daily consume is almost equally split three ways, _____
7 More experimentation would need to be done _____
8 Foods that were associated with non-sweet or that had slightly bitter components _____

A and the companies use their knowledge to put sugar to work for them in countless ways.
B with sugar derived from sugar cane, sugar beets, and the group of corn sweeteners.
C have now been made sweeter.
D and they are all hooked up to the parts of the brain.
E for this notion to gain currency among nutritionists.
F but rather the result of the massive amounts of sugar being added to processed foods.
G how major food companies manipulate processed food to make us eat more.
H they stuff themselves.

Phrase hunt

10E **Find the following expressions in the text.**

1 vaikuttaa ihmeellisillä tavoilla _____

2 lasten sokerinhimo _____

3 julkaistiin vuonna 1901 _____

4 ruoan valmistajat ovat hyvin tietoisia _____

5 leipää, joka ei mene vanhaksi _____

6 eivät ehkä kykene tunnistamaan _____

7 vähentää syömistään _____

8 Ei ole sietokykyä _____

9 kehottaa ihmisiä lopettamaan syöminen

_____

10 nykyinen liikalihavuuden lisääntyminen

_____

STUDY TIP

Science writing

Science writing is usually focused on actions, results or experiments. The person carrying out the work is less important. This is why the passive form is so often used in academic and scientific writing.

Example
Blood samples were taken every 6 hours. (passive)
The nurse took blood samples every 6 hours. (active)

The passive form directs our attention to the blood samples, not the person taking them.

Work in pairs. Try changing the following sentences into the passive form:
- We placed the magnets opposite one another. → The magnets...
- I tested the soil for traces of arsenic.
- An engineer had designed the car heaters to operate at 12 volts.
- The army tested the bomb on a remote island in the South Pacific.

10F **Fill in the gaps with the help of the Finnish clues. Pay attention to the tenses. Add the prepositions if needed.**

Good news for chocolate lovers! Your **1** _____ (himo) chocolate may be good for your **2** _____ (terveys). You can trust your **3** _____ (makunystyrät) to know what is good for you, after all.

According to a study **4** _____ (tehdä) Crichton, Elias and Alkerwi, eating the sweet treat that pampers your palate has a positive association with cognitive performance.

The researchers found that regularly eating chocolate was positively **5** _____ (yhdistää) cognitive function "irrespective of other dietary habits".

More frequent chocolate **6** _____ (kulutus) was, among other things, positively linked to better memory, abstract reasoning and scanning, and improved organizational skills.

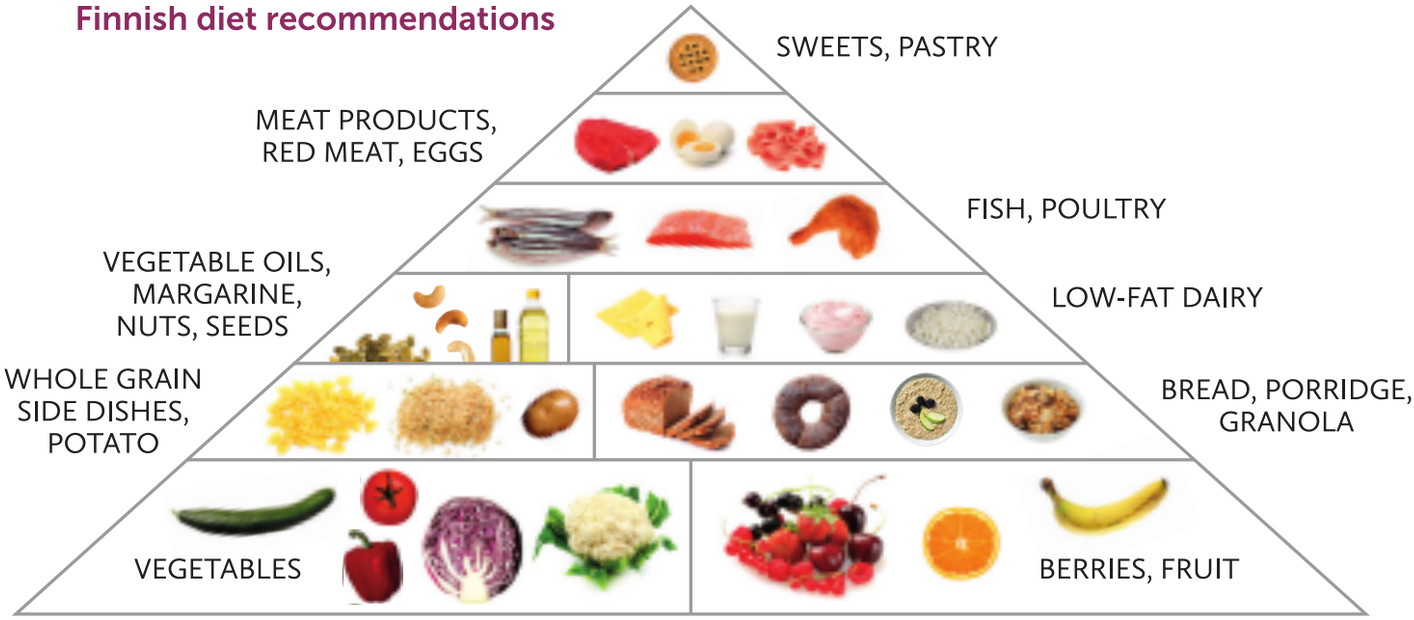
Apparently it is the flavonoid content that makes dark chocolate **7** _____ (erityisen) healthy. The highest levels of flavonoid **8** _____ (ainesosat) have been **9** _____ (huomata) in both black and green tea, but they are also present in all kinds of berries, quinoa, onions and a variety of other fruit and vegetables.

The findings of Crichton et al. support a range of recent clinical **10** _____ (kokeet). The study **11** _____ (antaa ymmärtää) that a regular intake of cocoa flavonoids **12** _____ (näyttää) to have beneficial effects on cognitive functions.

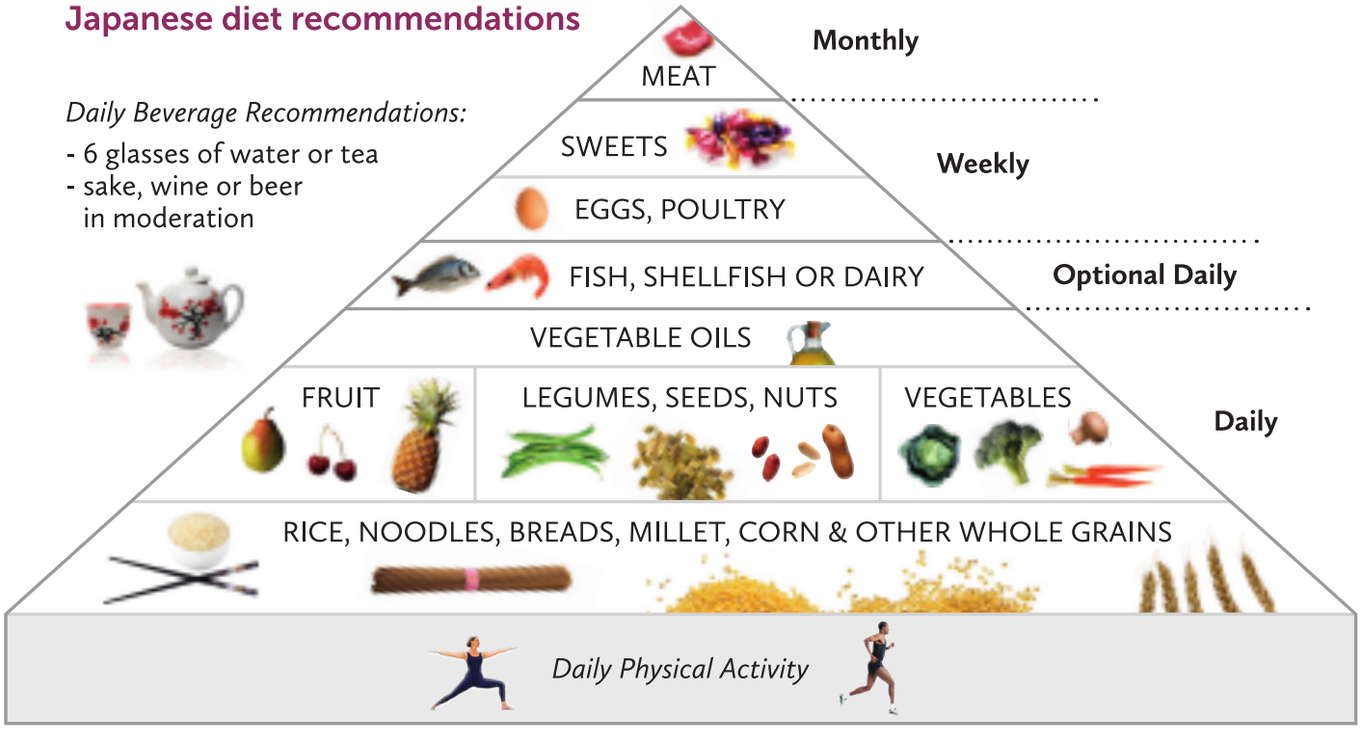
10G **Here are two charts giving the daily recommendations for a healthy diet. One is from Finland, the other from Japan. In pairs or small groups, compare and contrast the two food pyramids.**

- How do the recommendations differ? Why do you think they differ?
- Do your eating habits correspond to the suggested recommendations?
- What should you change in your daily diet?

Finnish diet recommendations



Japanese diet recommendations



Daily Beverage Recommendations:
- 6 glasses of water or tea
- sake, wine or beer in moderation

10H Choose the correct preposition. All the prepositions are from text 10. There is one extra preposition.

with after from on up for with in at of on

Jo confronted me **1** _____ the facts: I was drinking, **2** _____ average, two cans of soda a day. He was right, of course. I was crazy **3** _____ it. I liked the taste, I liked the bubbles, I liked the "mouthfeel" – **4** _____ sum, I liked my soda. I guess I associated it **5** _____ parties and having fun. "That's just it," Jo said. "**6** _____ the root of your love affair with soda is a very clever advertising campaign! Are you aware **7** _____ the fact that there are roughly nine teaspoons of sugar in that can of soda you're drinking right now? I know I can't prevent you **8** _____ drinking soda, but can't you at least cut back **9** _____ the number of cans?" I stopped listening. Ever since Jo hooked **10** _____ with this nutritionist from Atlanta he's been on my case, making little suggestions about a healthier diet. I was fed up with him.

10I People are becoming increasingly aware of the problems caused by the consumption of too much sugar. Listen to three reports related to the use of sugar in processed food and the fast-food industry. Choose the correct alternative.

Before listening take a look the following words.

outlet tehtaanmyymälä
condiment mauste
sag laskea, notkua, painua
supply tarjonta
gastronomic feat gastronominen saavutus/urotyö
pulp hedelmäliha
fibre kuitu
concentrate tiiviste, keskittyä, keskittää
devoid of täysin vailla jotakin
staggering hämmästyttävä
metabolic syndrome metabolinen oireyhtymä (aineenvaihduntaan liittyvä)
cardiovascular disease sydän- ja verisuonitauti
confectionary makeiset
***take precedence** laittaa etusijalle/arvojärjestykseen

Love you, sugar

1 According to a customer's tweet, the French fries with a double chocolate topping
   a) tasted a bit odd.
   b) were not what they expected at all.
   c) were excellent.

2 Why did the company want to introduce chocolate French fries?
   a) To impress their American customers.
   b) To improve their sales.
   c) To show the food industry that the impossible was possible.

3 What is taken out when fruit juice concentrate is made?
   a) Almost all of the natural ingredients and water.
   b) Only the sour flavours.
   c) Only the water.

4 Companies can say on the box that a product 'contains real juice' because
   a) the fruit pulp is saved and used in the concentrate.
   b) the concentrate used has the sugar of the original fruit in it.
   c) they use pear and grape juice in all juices.

5 The National Health Service in Britain has suggested
   a) putting a tax on all the unhealthy snacks sold in hospitals.
   b) putting a tax on their services in hospitals.
   c) reducing the number of doctors working in hospitals.

6 Doctors in the UK think
   a) that the rise in hospital costs is worrying.
   b) that the government should do more to control the sugar industry, by increasing tax, for example.
   c) that the government should ban all sales of sugary foods and fizzy drinks.

10J Choose task A, B or C. Write about 150–250 words.

A My healthy/unhealthy daily diet
Take a look at the charts in exercise 10G. Write about your daily diet. Give reasons for your choices.

B The sweet life
What are your favourite sweet things? Do you like baking? What kind of desserts do you like to eat? Write a few paragraphs about your relationship to sweet things.

C Balanced meals throughout the day
You are a nutritionist. You have been asked to give a speech to students at a Finnish high school. Use the information in exercise 10G when you write your speech.

10K Project work. Work in pairs or small groups. Choose task A, B or C.

A Compare dietary recommendations in different parts of the world.
Go online to find the dietary recommendations from different countries. Present your findings.

B Compare the sugar, salt and fat levels in a number of food items that you regularly eat. Or you could just focus on sugar, for example. Present your findings. Use a diagram or a pie-chart to support your presentation.

C Interview the cooks at your school cafeteria to find out about the sugar and salt content in the meals served at school. Present your findings using diagrams or graphs to support your points.

Topic 11

Pronunciation

Dum inter homines sumus, colamus humanitatem.
As long as we are among humans, let us be humane.
(Seneca the Younger, Roman Stoic philosopher, statesman and dramatist, c. 4 BcE–CE 65)

Latin words in English

Many Latin words are frequently used in English. The pronunciation, spelling and plurals of these words can be tricky. In this section, we focus on the more commonly used

- Latin loanwords in English
- Latin plural forms
- abbreviations and phrases.

11A Work in pairs. First listen to how the words are pronounced. Then take turns reading the words aloud.

	singular	plural
1	analysis	analyses
2	bacterium	bacteria
3	basis	bases
4	cactus	cacti (cactuses)
5	crisis	crises
6	criterion	criteria
7	diagnosis	diagnoses
8	fungus	fungi

	singular	plural
9	hypothesis	hypotheses
10	medium	media
11	millennium	millennia
12	nucleus	nuclei
13	phenomenon	phenomena
14	series	series
15	species	species
16	stimulus	stimuli

- Translate the words. Use your vocabulary app if you need to.

11B

Choose and underline the correct form of the words in bold. Take turns reading the sentences out loud. Then listen and check your answers.

1 The company carried out a thorough **analysis** / **analyses** of the situation.
2 Different safety **criterion** / **criteria** were used in different countries.
3 Dr Who discovered a new type of **fungus** / **fungi** growing on the walls of the old school.
4 An early **diagnosis** / **diagnoses** helps doctors to contain the spread of a virus.
In the near future, computerized medical **diagnosis** / **diagnoses** will help everybody.
5 Some areas of the brain will respond to visual **stimulus** / **stimuli**.
6 Electrons are found in clouds that surround the **nucleus** / **nuclei** of an atom.
7 Scientists demonstrated a rare chemical **phenomenon** / **phenomena** that could be used in harvesting solar energy.

11C

We often use Latin abbreviations in English, but it is sometimes difficult to know how to pronounce them. First listen to how these common abbreviations are said.

- Tick what you hear. The first one has been done for you.
- Then translate the abbreviations into Finnish, using your vocabulary app if needed.

1	☑ a.m.	☐	ante meridiem	_____
2	☐ CV	☐	curriculum vitae	_____
3	☐ c. or ca.	☐	circa	_____
4	☐ cf.	☐	confer	_____
5	☐ et al.	☐	et alia	_____
6	☐ etc.	☐	et cetera	_____
7	☐ p.m.	☐	post meridiem	_____
8	☐ P.S.	☐	post scriptum	_____
9	☐ vs.	☐	versus	_____

10	☐ e.g. / for example	☐	exempli gratia	_____
11	☐ i.e. / that is	☐	id est	_____
12	☐ N.B. / note	☐	nota bene	_____

11D **Work in pairs. Read the following dialogue out loud. Then listen and check if you have pronounced the abbreviations correctly.**

A: Meet me at the station at 2 p.m. We'll take the first train out.
B: OK.
A: And don't forget your CV!
B: Of course not. CV, laptop, list of references, etc.
A: And you haven't forgotten the script, have you? *Krumm vs Kirsten*?
B: Got it. Although that script is c. 1972. I hope it's OK.
A: I'm sure it'll be fine. Your interview's at 10 a.m., right?
B: Yeah. I'm ready. Nervous, but ready. P.S. I love you.
A: Never mind love. Focus on what's important, i.e. getting a J.O.B!

11E **Match the expressions.**

1	ad hoc _____	A	elinympäristö
2	alma mater _____	B	päin vastoin
3	bona fide _____	C	käytännössä, tosiasiassa
4	carpe diem _____	D	tartu hetkeen
5	de facto _____	E	vallitseva olotila
6	flora _____	F	tilapäinen, tilapäisesti
7	fauna _____	G	eläimet, eläimistö
8	habitat _____	H	koulu/yliopisto, jota on käynyt
9	Homo sapiens _____	I	kasvisto, tietyn alueen kasvit
10	status quo _____	J	henkilöä kohti
11	vice versa _____	K	ihminen
12	per capita _____	L	vilpitön, hyvässä uskossa

11F **Work in pairs. First choose and underline the correct Latin phrase. Then take turns reading your sentences out loud. Finally, listen and check that both your answer and pronunciation were correct.**

1 Ladies and gentlemen, our beloved **ad hoc**/ **alma mater** needs our help. As former students, we should all donate generously to the restoration fund.
2 Why worry about tomorrow? **Carpe diem** / **De facto** should be our motto.
3 The Mars committee only dealt with problems on an **alma mater** / **ad hoc** basis. It was impossible to plan anything in advance.
4 Only **carpe diem** / **bona fide** *Star Trek* fans will be allowed onto the set to meet R2D2.
5 She's the **de facto** / **alma mater** head of the physics department although she's never been formally appointed.
6 I don't like zoos. I prefer to see animals in their natural **habitat** / **fauna**.
7 Oil companies are content with the current **bona fide** / **status quo** and are unlikely to support the development of renewable energy.

Morocco: solar power plant in the desert.

Topic 12

Read on

One man's trash is another man's treasure.
(Proverb)

12A **How can you fight climate change? Here are some suggestions to save the planet from a British website. Match the English with the Finnish translations.**

1 Live in a flat rather than in a house of your own. _____
2 Install insulation to improve the energy efficiency of your home. _____
3 Take quick showers to avoid wasting water. _____
4 Install solar panels if possible. _____
5 Use public transport instead of your own car. _____
6 Use energy-saving light bulbs. _____

A Käy nopeasti suihkussa välttääksesi veden haaskaamista.
B Asu mieluummin kerrostalohuoneistossa kuin omakotitalossa.
C Käytä energiansäästölamppuja.
D Laita hyvät eristeet parantaaksesi kotisi energiatehokkuutta.
E Käytä julkista liikennettä oman auton sijasta.
F Asenna aurinkopaneelit, jos mahdollista.

12B **Energy and you. In pairs or in small groups, discuss the following questions.**

1 Do you know the price of a full tank of fuel for a car or a moped car?
2 How often do you need to fill up your car, or your parents' car?
What is the fuel consumption of your vehicle?
3 How is your home heated? Oil? Electricity? Ground heating? District heating?
Solar panels? Wind power? Wood pellets? Firewood?
4 Do you use any energy-saving devices at home? Which ones?
Do you know if any are used at school?
5 In what ways can waste be used as an energy source?

ground heating maalämpö
district heating kaukolämpö

Topic 12

Powered by poo

It's a free, natural product. Every mammal on earth produces it. And best of all, it will never run out. As an inexhaustible resource and a possible answer to our ever-increasing energy needs, it seems too good to be true. It is also the subject of many rude jokes and easy to make fun of. We're referring to poo, of course, excrement, human waste.

Grand Junction, Colorado

The idea of using excrement as fuel, or turning organic waste into biogas, has been around for a long time. Dairy farms all over the US have been doing this for over 30 years, for example. Waste collected in "digester" tanks produces enough methane to run generators, which in turn provide the electricity needed to run the farm. The town of Grand Junction in Colorado has recently started to use renewable natural gas (RNG) on an industrial scale. The Persigo Wastewater Treatment Plant processes 8m gallons of the town's human waste into RNG, also known as biomethane. It is made possible through a process called anaerobic digestion, which breaks down organic matter into something called raw biogas. The biogas is then collected and upgraded to RNG, which can be used to generate electricity or heat or as a transportation fuel. Grand Junction is currently using RNG to fuel about 40 vehicles, including garbage trucks, street sweepers, dump trucks and transit buses. Dan Tonello, wastewater services manager for Grand Junction, proudly mentions that they were the first municipal wastewater facility in the US to use biogas as vehicle fuel.

Bret Guillory, utility engineer for the city, is quick to point out the environmental benefits, saying that greenhouse gases may be reduced by as much as 80%. "The old wastewater treatment process involved simply burning off raw gas, releasing carbon dioxide into the atmosphere. Now the gas is pumped into a pipeline instead, fuelling our vehicles. Furthermore, we have calculated that the whole process will start paying for itself in about seven years, which is when investors will start making a profit."

Bristol, England

On the other side of the Atlantic, Bristol has introduced a 40-seater Bio-Bus (otherwise known as the poo bus) which is powered entirely by locals' poop as part of an ambitious environmental campaign. The Bio-Bus fuels up at the Bristol sewage treatment works, where the human waste of more than 32,000 households is converted into bio methane. The bus can travel 2.5 million miles over the course of a year with the waste produced by the households along the route. In this sense, the Bio-Bus is unique, being powered by people living in the local area, including quite possibly those riding on the bus itself. If the bus proves to be successful, the company First West of England will consider introducing an entire fleet of poo buses.

Again, the environmental benefits are clear: the Bio-Bus is quieter than other public vehicles, and does not exude any odours, thus cutting down on both noise and air pollution. It has the added advantage of putting waste to work, instead of adding to landfills. According to the Environmental Protection Agency (EPA), whenever fossil fuels are replaced by RNG, greenhouse gas emissions decrease. Furthermore, methane from rotting waste that otherwise would have been discharged into the atmosphere is being used as a renewable energy source instead.

And finally, if implemented nation-wide, the process will have the additional benefit of drastically reducing our dependence on crude oil and gas, which in turn could have huge geopolitical implications.

The Bio-Bus: waste not want not.

Teething problems

However, there are some problems to overcome. First of all, poo-related technology suffers from an image problem. "People don't really want to finance shit," says Jeremy Kranowitz, executive director at Sustainable America. "No matter how you spin it, poop is not sexy. It's hard to convince stakeholders to invest in this area." A second problem is that investors are not yet as familiar with RNG as they are with fossil fuels and natural gas, and they are wary of backing something they don't understand. Infrastructure is a third issue. In order to get RNG facilities up and running, a dedicated supply of waste is needed, which means long-term contracts and financing. A final problem for RNG in the US in particular, is one that may prove to be very difficult to overcome: the entrenched interests of oil and gas company lobbyists, who to date have managed to thwart efforts to change from fossil fuels to RNG.

Despite these obstacles, in the long term RNG may well provide the solution to our energy crisis. RNG is practical because it can fuel anything that runs on natural gas. It is produced, transported and used in accordance with all the same rules as fossil natural gas. Human poop is not the only waste that produces RNG, but other renewable resources like landfills, food waste and animal manure can also be used. And finally, we will never run out.

Read the following comments on this subject that were posted online.

@IanMöller Perth, Australia
A poo bus? Is this a joke? Are we going to have 40 toilet seats instead of seats for long distance refuelling?

@SarahWhite Austin, Texas
Let's all work together towards clean energy. Well, maybe not 'clean', but you know what I mean!

@AmandaStewart Glasgow, Scotland
If I have a large family, can I get a tax rebate? After all, larger families would be contributing more fuel.

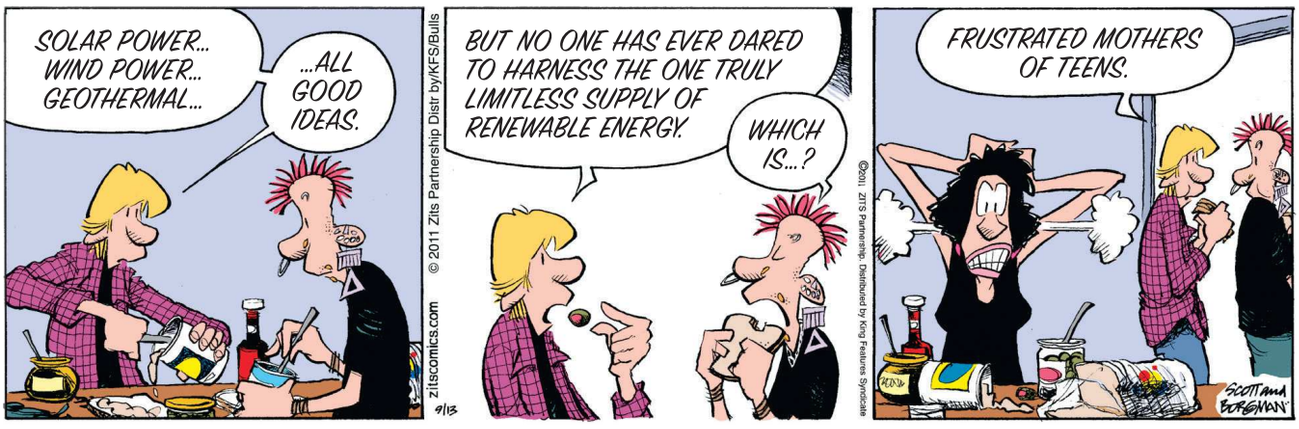
@RosaWyndham Chicago
Can I give bags of poop as fare payment?

@JoschaMueller Germany
I feel sorry for the mechanics who have to work on the poo bus – what a shitty job!

power /pauə/ antaa energiaa, antaa voimaa; voima, energia, teho
mammal /mæml/ nisäkäs
***run out** /rʌn aut/ loppua
inexhaustible /ˌɪnɪgˈzɔːstəbl/ ehtymätön, tyhjentymätön, väsymätön
resource /rɪˈsɔːs/ varat, rikkaudet, mahdollisuudet
ever-increasing /ˌevəɪnˈkriːsɪŋ/ alati kasvava
fuel /fjuːəl/ polttoaine; tankata, varustaa polttoaineella
organic waste /ɔːˈgænɪk weɪst/ biohajoava, eloperäinen jäte
dairy /deəri/ meijerituote, maito-
"digester" tank /daɪˈdʒestə tæŋk/ mädätyslaitos
methane /miːθeɪn/ metaani
generator /dʒenəreɪtə/ generaattori
renewable natural gas (RNG) /rɪˈnjuːəbl, rɪˈnuːəbl nætʃərəl gæs (ˌɑːr en ˈdʒiː)/ jalostettu/väkevöity biokaasu, biometaani
on an industrial scale /ɒn ən ɪnˈdʌstriəl skeɪl/ teollisessa mittakaavassa
wastewater treatment plant /weɪstwɔːtə triːtmənt plɑːnt, plænt/ jäteveden käsittelylaitos
anaerobic digestion /ˌæneəˈrəubɪk daɪˈdʒestʃən, dɪˈdʒestʃn/ mädätys
***break down** /breɪk daun/ hajottaa, rikkoa, romahtaa, purkaa osiin
raw biogas /rɔː baɪɒgæs/ raaka/käsittelemätön biokaasu
upgrade /ʌpgreɪd/ jalostaa, nostaa jalostus-astetta, parantaa, ylentää, päivittää
transportation fuel /ˌtrænspɔːˈteɪʃn fjuːəl/ kulkuneuvoissa käytettävä polttoaine
garbage truck /gɑːbɪdʒ trʌk/ jäteauto
street sweeper /striːt swiːpə/ lakaisukone
dump truck /dʌmp trʌk/ lavakuorma-auto
municipal /mjuˈnɪsɪpl/ kunnallinen, kunnan
wastewater facility /weɪstwɔːtə fəˈsɪlɪti/ jäteveden käsittelylaitos
utility engineer /juːˈtɪlɪti ˌendʒɪˈnɪə/ ympäristöteknologian insinööri
environmental /ɪnˌvaɪrənˈmentl/ ympäristö-, ympäristöön liittyvä
greenhouse gas /griːnhaus gæs/ kasvihuonekaasu
***burn off** /bɜːn ɒf/ hävittää polttamalla
pipeline /paɪplaɪn/ putkisto, putki, johto
calculate /ˈkælkjuleɪt/ laskea, tehdä laskelmia
investor /ɪnˈvestə/ investoija, sijoittaja
***make a profit** /meɪk ə prɒfɪt/ tehdä voittoa
sewage treatment works /sjuːɪdʒ triːtmənt wɜːks/ jätevedenpuhdistuslaitos
convert /kənˈvɜːt/ muuttaa, vaihtaa, kääntää
fleet /fliːt/ autokanta, laivasto, (rautatie)vaunusto
exude /ɪgˈzjuːd/ päästää, erittää, tihkua, value, säteillä
added advantage /ædɪd ədˈvɑːntɪdʒ, ədˈvæntɪdʒ/ lisähyöty
fossil fuel /fɒsɪl fjuːəl/ fossiilinen polttoaine
replace /rɪˈpleɪs/ korvata
emission /ɪˈmɪʃn/ päästö
decrease /dɪˈkriːs/ vähentää, vähentyä
rot /rɒt/ mädäntyä
discharge /dɪsˈtʃɑːdʒ/ vapauttaa, päästää (ulos), purkaa (lasti), päästää menemään
implement /ɪmplɪment/ toteuttaa, panna toimeen
nation-wide /ˌneɪʃnˈwaɪd/ maanlaajuinen, valtakunnallinen
dependence on /dɪˈpendəns ɒn/ riippuvuus jstak
crude oil /kruːd ɔɪl/ raakaöljy
implication /ɪmplɪˈkeɪʃn/ seuraamus
teething problems /tiːðɪŋ prɒbləms/ lastentauti
***overcome, overcame, overcome** /ˌəuvəˈkʌm, ˌəuvəˈkeɪm, ˌəuvəˈkʌm/ voittaa, päästä jostakin
poo-related technology /ˌpuːrɪˈleɪtɪd tekˈnɒlədʒi/ kakkaan liittyvä teknologia
finance /faɪnæns/ rahoittaa
executive director /ɪgˈzekjutɪv dɪˈrektə, daɪˈrektə/ toimitusjohtaja
***spin, spun, spun** /spɪn, spʌn, spʌn/ kehitellä, keksiä (tarina), punoa, kiepauttaa, lingota (pyykkiä)
stakeholder /steɪkhəuldə/ osakas
investor /ɪnˈvestə/ sijoittaja
wary of /weəri əv/ varovainen
dedicated /dedɪkeɪtɪd/ kohdennettu, omistautunut, vannoutunut
supply of /səˈplaɪ əv/ toimitus, jakelu, hankinta
in particular /ɪn pəˈtɪkjulə/ erityisesti
entrenched /ɪnˈtrentʃt/ vakiintunut, juurtunut
lobbyist /lɒbɪɪst/ lobbaaja
to date /tə deɪt/ tähän päivään mennessä, tähän päivään asti
thwart /θwɔːt/ pilata, lannistaa, estää
obstacle /ɒbstəkl/ este
in accordance with /ɪn əˈkɔːdns wɪð/ jnk mukaisesti
manure /məˈnjuə/ lanta

12C Are the following statements true or false? Correct the false ones.

		True	False
1	Just a few years ago some dairy farmers in Grand Junction had the idea of using the organic waste on their farms as a source of energy.		
2	Anaerobic digestion is a process whereby waste is changed into raw biogas that can be used as fuel.		
3	Pumping gas into a pipeline instead of burning it off could decrease greenhouse gases significantly.		
4	This new wastewater treatment system has motivated investors from the start because it is so profitable.		
5	The human waste of locals who live along the route of the Bristol Bio-Bus is used to fuel the bus.		
6	Some positive aspects of the Bio-Bus are that it is virtually scentless and almost soundless.		
7	There will be fewer greenhouse gas emissions if material from the landfills is no longer burnt off.		
8	Since investors are familiar with human waste, they can effortlessly be won over to finance RNG.		
9	Committed suppliers of human waste are needed in order to launch plants to produce RNG and keep them functioning.		
10	Despite the possibilities of using RNG as a source of energy, in the long term this form of energy is probably not sustainable.		



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INFO BOX

Places that make things

Question: What is the difference between the words factory, plant, mill, works and facility?
Answer: Sometimes these words can be used as synonyms (e.g. paper factory, paper mill), but there are slight differences in meaning.

- A **factory** is a place in which items are manufactured (i.e. pieces of things are put together.) e.g. shoe factory
- A **plant** is for production on a massive scale. e.g. car plant, power plant.
- A **mill** is a place where a product is created by passing raw material through a series of machines. (A sawmill takes logs and turns them into planks.) e.g. textile mill, steel mill.
- A **works** is an old word for a place that usually produces metals. e.g. ironworks
- A **facility** is often used in the US. Because the word has technical associations, it is used to describe power plants, among other things.

12D Answer the questions in Finnish.

1 Kuinka maatiloilla on hyödynnetty lantaa energian tuottamiseen?
2 Mitä Persigon jätevedenkäsittelylaitoksella tapahtuu?
3 Mitä eroa on uudella ja vanhalla jäteveden käsittelyllä Grand Junctionissa?
4 Mikä tekee Bristolin biobussista ainutlaatuisen?
5 Mitä hyviä puolia biobussilla on?
6 Millaisia haasteita ihmisjätöksiä käyttävällä teknologialla on voitettavanaan?
7 Mitä teksti kertoo uusiutuvan luonnonkaasun tulevaisuuden näkymistä?

12E Translate sentences 1–2 into Finnish and 3–5 into English.

1 The new fuel might start paying for itself over the course of a year.
2 Despite obstacles, there are some investors who are ready to invest in biogas.
3 Biobusseja ei vielä valmisteta teollisessa mittakaavassa.
4 Meidän tarvitsee löytää lisää uusiutuvan energian lähteitä.
5 Monet ihmiset kärsivät melusta ja ilmansaasteista.

12F Match the words that are similar in meaning. Translate them into Finnish. Make sentences in English using at least three of the words.

				Finnish
1	reduce _____	A	finance	_____
2	discharge _____	B	director	_____
3	works _____	C	known	_____
4	excrement _____	D	decrease	_____
5	familiar _____	E	release	_____
6	invest _____	F	plant	_____
7	manager _____	G	human waste	_____
8	interest _____	H	oil	_____
9	electricity _____	I	profit	_____
10	fuel _____	J	power	_____

12G Choose the correct preposition.

Organic waste can be turned **1** **in** / **into** biogas. Biogas **2** **after** / **in** turn can be upgraded **3** **–** / **to** renewable natural gas (RNG). RNG can be used **4** **for** / **of** generating electricity or **5** **as** / **–** vehicle fuel. Using RNG, greenhouse gases may be reduced **6** **by** / **–** up to 80%. Could this be the answer **7** **after** / **to** our energy crisis?

The British Bio-Bus is powered **8** **by** / **of** human waste that is produced **9** **–** / **in** the local area. It is possible that the people supplying it are riding **10** **with** / **on** the bus themselves. The only problem is that technology related **11** **with** / **to** excrement suffers **12** **–** / **from** a lack of investors. They are wary of investing **13** **of** / **in** an area that they are not so familiar **14** **–** / **with**.

12H A clean, flushing toilet is something most of us take for granted. Listen to two Australian students, Alex and Simone, talk to Alex's mother about the different types of toilets they have encountered on their travels abroad. Tick the boxes as you listen. The first one has been done for you.

	Ethiopia	Poland	Paris	Japan	Australia	Finland	North Africa	Nepal
toilet managers	☐	☑	☐	☐	☐	☐	☐	☐
metal screen for privacy	☐	☐	☐	☐	☐	☐	☐	☐
self-cleaning unisex toilets	☐	☐	☐	☐	☐	☐	☐	☐
pit latrine / long drop	☐	☐	☐	☐	☐	☐	☐	☐
squat models	☐	☐	☐	☐	☐	☐	☐	☐
urine as fertiliser	☐	☐	☐	☐	☐	☐	☐	☐

12I Run for it! In English, "run" can mean various things. It is very often used in idiomatic expressions too. Translate the following sentences taken from text 12 into Finnish. Pay attention to the underlined parts.

1 It will never run out.
2 Waste collected in "digester" tanks produces enough methane to run generators, which in turn provide the electricity needed to run the farm.
3 In order to get RNG facilities up and running, a dedicated supply of waste is needed.
4 RNG is practical because it can fuel anything that runs on natural gas.

12J Are you running out of energy? Choose the correct alternative.

1 "Run into someone" means that you
   a) meet somebody you know unexpectedly.
   b) accidentally trip over a competitor in a race.

2 "Run the show" means that you
   a) perform as a comedian at the theatre.
   b) are in charge of an event.

3 "Run in the family" means that
   a) everybody in the family likes running together.
   b) a characteristic is shared by several family members.

4 "Run around in circles" means that
   a) you try to do a lot but you don't make much progress.
   b) you run around a track.

5 "Run for president" means
   a) to assist the president by running an errand.
   b) to be a candidate in a presidential election.

6 To be "on the run" means that
   a) you are generally keeping fit by jogging.
   b) you are trying to escape the police.

The gas pipeline is up and running.

UNIT 4

Fast forward

Topic 13

Food for thought

It's crazy that you can accidentally make a person, but you can't accidentally make a pizza.
(From the Twitter account of bmurray)

13A **As technology advances, we're finding new ways to apply it to food and beverages. How would you rate the following innovations?**

		currently in use	plausible in the future	pure sci-fi
1	A pizza vending machine			
2	Mealworm burgers			
3	Food that keeps forever			
4	3D-printed complete meals			
5	Lab-grown meat			
6	Pills for food			
7	Vegetables grown indoors, without soil and sunlight			
8	Edible packaging			
9	Non-toxic alcohol			
10	Using grass and leaves as a food source for humans			

vending machine myyntiautomaatti
mealworm jauhopukin toukka
soil maaperä, multa

13B Listen to the following poems. Then answer the questions in pairs.

1 How do the narrators' views on food differ?
2 Which view is closer to your own?
3 How important is the origin of food you eat to you?
4 How could you make your diet more environmentally friendly?

The Health-Food Diner

by Maya Angelou

No sprouted wheat and soya shoots
And Brussels in a cake,
Carrot straw and spinach raw,
(Today, I need a steak).

Not thick brown rice and rice pilaw
Or mushrooms creamed on toast,
Turnips mashed and parsnips hashed,
(I'm dreaming of a roast).

Health-food folks around the world
Are thinned by anxious zeal,
They look for help in seafood kelp
(I count on breaded veal).

No smoking signs, raw mustard greens,
Zucchini by the ton,
Uncooked kale and bodies frail
Are sure to make me run

to

Loins of pork and chicken thighs
And standing rib, so prime,
Pork chops brown and fresh ground round
(I crave them all the time).

Irish stews and boiled corned beef
and hot dogs by the scores,
or any place that saves a space
For smoking carnivores.

"The Health-Food Diner" from SHAKER, WHY DON'T YOU SING? by Maya Angelou, © 1983 by Maya Angelou. Used by permission of Random House, an imprint and division of Penguin Random House LLC. All rights reserved.

Point of View

by Shel Silverstein

Thanksgiving dinner's sad and thankless
Christmas dinner's dark and blue
When you stop and try to see it
From the turkey's point of view.

Sunday dinner isn't sunny
Easter feasts are just bad luck
When you see it from the viewpoint
Of a chicken or a duck.

Oh how I once loved tuna salad,
Pork, lobsters, lamb chops too
Till I stopped and looked at dinner
From the dinner's point of view.

"Point of view" from WHERE THE SIDEWALK ENDS by Shel Silverstein. © 1974, renewed 2002 Evil Eye, LLC. By permission of Edite Kroll Literary Agency Inc.

sprouted wheat idätetty vehnä
soya shoot soijapavun itu
pilaw pilahvi (riisiruoka)
turnip nauris
parsnip palsternakka
kelp merilevä
breaded veal leivitetty vasikanliha
zucchini kesäkurpitsa
kale lehtikaali
corned beef suolaliha
by the scores joukoittain, kymmenittäin
carnivore lihansyöjä

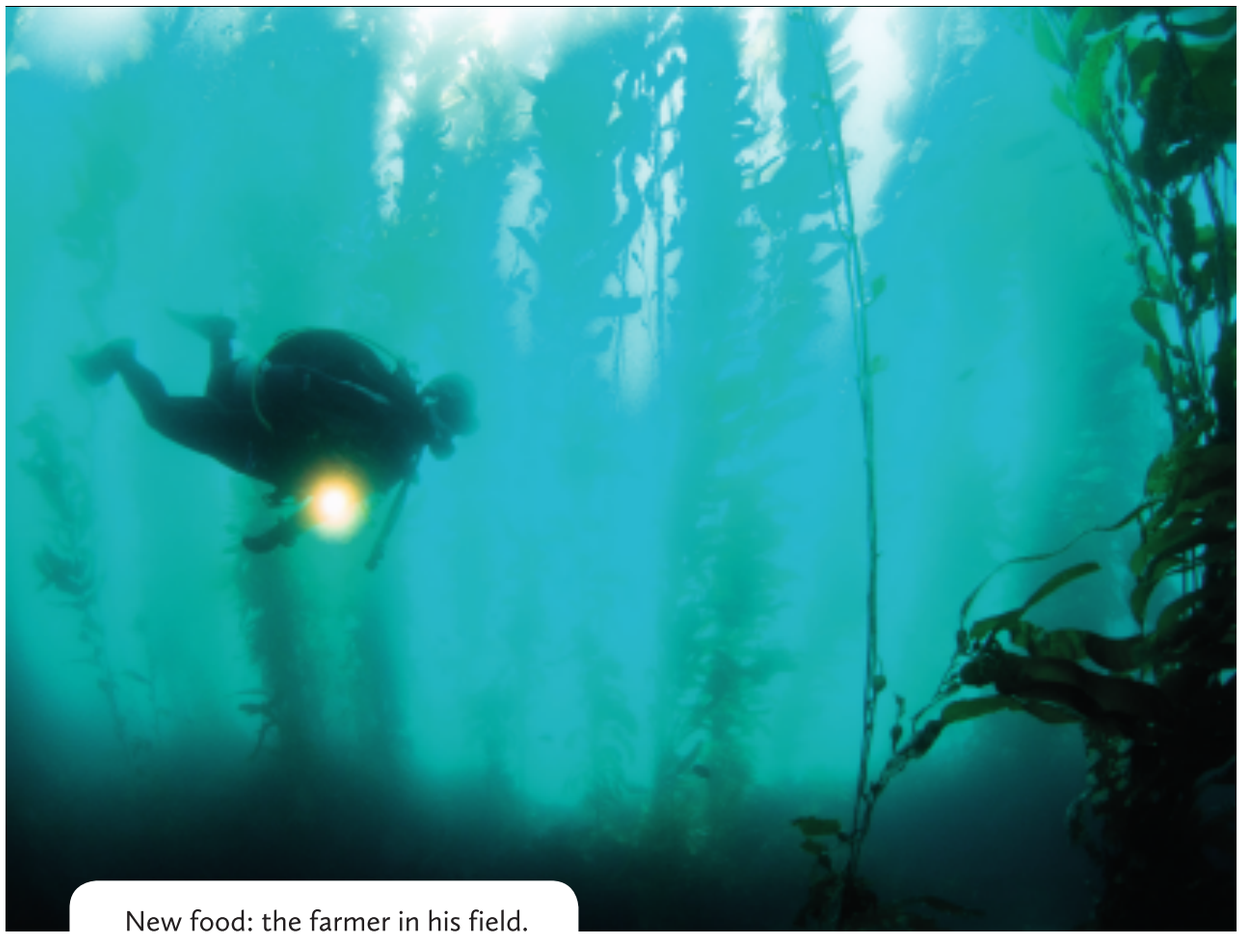
Topic 13 Key text

The future of food

Fifty years ago, when the world's population was less than half of what it is now, the answer to our increasing need for food was "the green revolution" – a massive increase in the use of hybrid seeds and chemical fertilisers. It worked. Today we grow nearly twice as much food as we did just a generation ago. But by 2050, there are likely to be 2.5 billion more people on earth – an extra China and India, in other words. This is not good news. Food, farm and water technologists will have to find innovative ways to grow more crops in places that, until now, were hard or impossible to farm. On top of that, we all may need to radically rethink our eating habits.

Stewart Brooks from *Biofood Weekly* interviewed bioengineer Dr Kirsten Levine and agricultural scientist Dan Chung to talk about new developments in the field.

population /ˌpɒpjuˈleɪʃn/ väestö
increasing /ɪnˈkriːsɪŋ/ kasvava, lisääntyvä
revolution /ˌrevəˈluːʃn/ vallankumous
increase /ˈɪnkriːs/ kasvu, nousu, lisääntyminen
hybrid /haɪbrɪd/ hybridi, risteymä
seed /siːd/ siemen
fertiliser /fɜːtɪlaɪzə/ lannoite
likely /laɪkli/ todennäköinen
billion /bɪljən/ miljardi
innovative /ɪnəvətɪv, ɪnəveɪtɪv/ innovatiivinen, kekseliäs
crop /krɒp/ vilja, sato
on top of that /ɒn tɒp əv ðæt/ sen lisäksi
radically /rædɪkli/ täysin, perin pohjin
bioengineer /ˌbaɪəuˌendʒɪˈnɪə/ biotekniikan insinööri
agricultural /ˌægrɪˈkʌltʃrəl/ maatalous-, maanviljely-, maataloudellinen



New food: the farmer in his field.

INFO BOX

Cooperative learning

Cooperative learning means working together as a group to achieve a common learning goal. You first learn the material individually before teaching your assigned topic to your group members. Each member is responsible for teaching their own topic and actively listening to and learning from other group members.

Form groups of three. Then choose one of the three texts to study independently. Each group member should choose a different text.

Part 1 Artificial meat

Part 2 Sea vegetables

Part 3 Insects

13.1

Artificial meat

Stewart: It looks like meat, it feels like meat, and it is, in fact meat, although it has never been part of any living, breathing animal. To many, this may sound like something straight out of a sci-fi film, yet we are already producing meat in laboratories, aren't we? Can you talk us through the process?

Kirsten: Basically, **1 artificial meat is grown from stem cells in giant laboratory vats**. We have adapted the cutting-edge medical technique of tissue engineering, where individual cells are multiplied to form whole tissues, and applied it to food production. With a single cell from a living animal we could theoretically produce the world's annual meat supply.

Stewart: Why is the hunt for a meat substitute so critical at this point in time?

Kirsten: Mainly because Western eating habits, and **2 in particular our love affair with meat, is now spreading to China and other emerging economies**. To give you an example of the problem: per person, Americans eat approximately 210 pounds of meat every year. **3 Whereas in China, people traditionally eat about 66 pounds of meat annually**. If everybody on earth consumes 210 pounds of meat a year, well, you do the math.

Dan: Cattle need to eat, of course. In the US, nearly 70% of the grain and cereals grown is now fed to farmed animals. Grain that could be feeding humans instead. Now imagine how much more grain we would need to grow in order to feed all the cattle we would need to breed, to feed a world population who would like to eat more sausages and steaks, cheese and yogurt.

Kirsten: No doubt about it: this high-tech food may sound semi-disgusting to many people, but **4 artificial meat wins hands down in the environment stakes**, using far less water, energy and land than livestock do. Meat grown in labs could also be tailored to be healthier than meat from a farm. We could control the nutrient content and screen it for food-borne diseases, for example.
At the moment, artificial meat is not yet grown in large quantities since it's expensive to produce, and we still face some challenges in tissue engineering.

Stewart: I've tried an artificial hamburger patty before this interview. I was sure it would taste of nothing at all, since meat needs blood and fat to give it some taste, right? But I was pleasantly surprised. It tasted very similar to ordinary beef patties, even if the texture was a little less juicy.

Dan: Well, **5 the texture in ordinary beef patties varies greatly too, probably because of the addition of pink slime**. Once only used in dog food and cooking oil, it's nowadays added as a cheap filler to 70% of ground beef for sale in the US.

Stewart: That's enough to put me off my hamburgers forever! Pink slime is a nasty substance. It's sprayed with ammonium hydroxide, to kill off all the bacteria, right?

Kirsten: Yes, using a cleaning product in order to sanitise the beef sounds gross, I know. But on the other hand, it does mean that every single bacterium is killed off, and that all parts of the animal actually get used, which is a good thing. Waste not, want not.

artificial /ˌɑːtɪˈfɪʃl/ keinotekoinen
stem cell /stem sel/ kantasolu
vat /væt/ allas, säiliö, sammio
cutting-edge /ˌkʌtɪŋ ˈedʒ/ huippuluokkaa oleva, huippu-
tissue /tɪʃuː/ kudos
multiply /mʌltɪplaɪ/ moninkertaistaa, monistaa, lisätä, kertoa
apply to /əˈplaɪ tu/ käyttää, soveltaa käytäntöön, hakea (paikkaa)
food production /fuːd prəˈdʌkʃn/ ruoantuotanto
annual /ænjuəl/ vuosittainen
supply /səˈplaɪ/ määrä, varasto, tarjonta; hankkia, järjestää, täydentää
substitute /ˈsʌbstɪˌtjuːt, ˈsʌbstɪtuːt/ korvike, sijainen; korvata, panna jonkin sijaan, toimia jonkin sijaisena
critical /krɪtɪkl/ ratkaiseva, kriittinen
emerging /ɪˈmɜːdʒɪŋ/ kasvava, nouseva
consume /kənˈsjuːm, kənˈsuːm/ kuluttaa, käyttää, syödä
grain /greɪn/ jyvä, vilja, jyvänen
cereal /sɪərɪəl/ viljakasvi, vilja, murot
***breed, bred, bred** /briːd, bred, bred/ kasvattaa, jalostaa, siittää, synnyttää
no doubt /nəu daut/ epäilemättä, varmasti
semi- /semi/ puoliksi, puolittain
***win hands down** /wɪn hændz daun/ voittaa helposti, olla ylivoimainen voittaja
in the environment stakes /ɪn ðiː ɪnˈvaɪənmənt steɪks/ ympäristön kannalta
livestock /laɪvstɒk/ karja
tailor to /teɪlə tu/ räätälöidä
nutrient /njuːtrɪənt, nuːtrɪənt/ ravintoaine, ravinne
screen /skriːn/ seuloa, valikoida, suojata; kaihdin, suojus, kuvaruutu, valkokangas
food-borne /ˌfuːdˈbɔːn/ elintarvikeperäinen, elintarvikkeiden aiheuttama
hamburger patty /hæmbɜːgə pæti/ hampurilaispihvi
pleasantly /plezntli/ iloisesti, miellyttävästi
texture /tekstʃə/ tuntu, koostumus, rakenne, pintavaikutelma
pink slime /pɪŋk slaɪm/ ”pinkki lima”, linkoamalla valmistettu lihavalmiste, jota on käsitelty ammoniakilla
filler /fɪlə/ täyteaine, täyte
***put someone off** /put sʌmwʌn ɒf/ saada tuntemaan vastenmielisyyttä, saada joku menettämään mielenkiintonsa
substance /sʌbstəns/ aine, aines, materiaali, olemus, sisällys
ammonium hydroxide /əˈməuniəm haɪdˈrɒksaɪd/ ammoniumhydroksidi, ammoniakin vesiliuos
sanitise /sænɪtaɪz/ puhdistaa, siistiä, desinfioida
gross /grəus/ törkeä, karkea; brutto-
bacterium, bacteria /bækˈtɪərɪəm, bækˈtɪərɪə/ bakteeri, bakteerit
Waste not, want not. /weɪst nɒt wɒnt nɒt/ Säästäminen kannattaa.

13.1C Translate the coloured sentences in the text into Finnish.

13.1D Answer the questions in English.

1 What are the pros and cons of artificial meat according to the text?
2 What is your opinion on lab-grown meat?
3 Do you think people will use artificial meat as part of their diet in the future? Why? Why not?

Phrase hunt

13.1E Find the following expressions in the text.

1 olemme soveltaneet sitä ruoantuotantoon _____

2 tällä hetkellä _____

3 vuosittain _____

4 ruokkiaksemme _____

5 Ei epäilystäkään _____

6 vaikkakin koostumus oli _____

13.1F Choose the correct word for each sentence.

The world's 1 **ordinary** / **annual** / **high-tech** meat consumption is expected to rise in the future. Scientists have adapted the 2 **individual** / **cutting-edge** / **similar** technology of tissue engineering to produce lab-grown meat. At the moment 3 **emerging** / **ordinary** / **artificial** meat is not grown in large quantities due to the high cost involved. Artificial meat may sound 4 **juicy** / **disgusting** / **medical** to many people, although it may be a healthier option than meat from a farm. Scientists are trying to make lab-grown hamburger patties taste 5 **critical of** / **similar to** / **different from** ordinary beef patties.

13.2

Sea vegetables

Stewart: Covering more than 70% of the earth's surface, our oceans seem like a logical place to look for answers to our future food problems. For thousands of years, sea vegetables have formed part of the daily Asian diet. The most well-known is marine algae, commonly known as seaweed. Containing a rich store of essential minerals like calcium, iodine and iron, there are more than 30 varieties that are eaten regularly. Will we all be eating seaweed in the future?

Dan: If you like sushi, you are already eating seaweed. But the latest buzzword in the field is microalgae. Reminding most people of a smelly pond, rather than a tasty meal, microalgae are surprisingly nutritious. These tiny photosynthetic plants turn energy from the sun into sugars and proteins, absorbing carbon dioxide in the process, and expelling oxygen. They may be one of the world's most overlooked foods, and a possible answer to at least some of our future food needs.

Growing sea vegetables.

Stewart: We're not talking about typical seaweed products like kelp or nori, but about the really tiny algae, right? What is it actually used for?

Dan: Nowadays, you can find microalgae in everything from animal feed to cooking oil. According to green business entrepreneur, Robert Henrikson, they are 20 times more productive than conventional crops. They don't require much water, and they can be grown in places where no other crops will grow, such as the ocean. The poster child of microalgae as a food source is of course spirulina, a form of blue-green algae that grows in fresh water.

Stewart: Spirulina was a food source for the Aztecs, wasn't it?

Dan: Right. And very healthy it is too. Dried spirulina contains more protein and iron per bite than ground beef, and it is superior to typical plant proteins, such as those found in legumes.

Stewart: Algae seem to be the answer to our food problems then. Admittedly, it doesn't look very appetising, but it's a superfood, and it ticks the sustainability box. So why isn't it part of our Western daily diet yet?

Dan: The first problem is cost. Spirulina is 30 times more expensive than dairy or meat. And, from a nutritional point of view, it is no better than either of those two conventional sources of protein. A second problem is that while algae are easily grown on a small scale, growing algae commercially has proven to be a complex and expensive process. A third problem, in my opinion, is something you mentioned earlier: microalgae look like something in a neglected fish tank. People do not associate it with mouth-watering, delicious dishes.

Stewart: So we have the technology and the scientific know-how to solve our future food problems in the form of microalgae grown in seawater. But it seems that cost is the biggest obstacle at the moment?

Dan: Yes, for the time being. But I think it's just a matter of time before we're all tucking into spirulina pizzas.

sea vegetable /siː vedʒətəbl/ merikasvi
surface /sɜːfɪs/ pinta; nousta pintaan
marine /məˈriːn/ meri-, meren-
alga, algae /ælgə, ældʒiː/ levä, levät
seaweed /siːwiːd/ merilevä
essential /ɪˈsenʃl/ tärkeä, oleellinen, välttämätön
calcium /kælsiəm/ kalsium
iodine /aɪədiːn, aɪədaɪn/ jodi
iron /aɪən/ rauta
buzzword /bʌzwɜːd/ muotisana, iskusana
pond /pɒnd/ lampi
nutritious /njuːˈtrɪʃəs, nuːˈtrɪʃəs/ ravinteikas
absorb /əbˈzɔːb/ imeä itseensä, omaksua
carbon dioxide /kɑːbən daɪˈɒksaɪd/ hiilidioksidi
expel /ɪkˈspel/ työntää ulos, karkottaa, erottaa (koulusta)
oxygen /ɒksɪdʒən/ happi
overlooked /ˌəuvəˈlukt/ unohdettu, ei ole huomattu
kelp /kelp/ ruskolevälaji (syödään yleensä tabletteina tai jauheena)
nori /nɒri/ merilevälaji (käytetään arkkeina esimerkiksi sushin valmistuksessa)
animal feed /ænɪml fiːd/ eläinten rehu
green business /griːn bɪznɪz/ vihreä talous
entrepreneur /ˌɒntrəprəˈnɜː/ yrittäjä
productive /prəˈdʌktɪv/ tuottava
conventional /kənˈvenʃənl/ tavanomainen, sovinnainen
poster child /pəustə tʃaɪld/ edustaja, yrityksen tai organisaation kasvot
spirulina /ˌspɪrəˈlɪnə, ˌspaɪrəˈlaɪnə/ ravinteikas sinivihreä mikrolevä
fresh water /freʃ ˈwɔtə/ makea vesi
superior to /suːˈpɪərɪə, sjuːˈpɪərɪə tu/ jotakin parempi, ylempi
legume /legjuːm, lɪˈgjuːm/ palkokasvi
appetising /æpɪtaɪzɪŋ/ ruokahalua kiihottava
tick the sustainability box /tɪk ðə səˌsteɪnəˈbɪləti bɒks/ täyttää kestävän kehityksen vaatimukset
nutritional /njuːˈtrɪʃənl, nuːˈtrɪʃənl/ ravinto-, ravitsemus-
on a small scale /ɒn ə smɔːl skeɪl/ pienessä mittakaavassa
neglected /nɪˈglektɪd/ laiminlyöty
associate with /əˈsəuʃɪeɪt, əˈsəusɪeɪt wɪð/ yhdistää, liittää johonkin
obstacle /ɒbstəkl/ este
tuck into /tʌk ɪntu/ pistää poskeensa, ahtaa sisäänsä

13.2C Match the beginnings and endings of the sentences so that they are in keeping with the text.

1 There are more than 30 commonly eaten varieties _____
2 Even though microalgae remind people of a smelly pond, _____
3 Microalgae are very productive to grow _____
4 Spirulina contains more protein and iron than ground beef, _____
5 Food made from microalgae isn't part of our daily diet yet _____
6 Sea vegetables might be _____

A because it's expensive to produce and it does not look very appetising.
B as they don't require much water.
C the answer to our future food problems.
D they are surprisingly nutritious.
E of marine algae, or seaweed.
F and it is superior to typical plant proteins.

13.2D Answer the questions in English.

1 What are the pros and cons of using sea vegetables as a food source?
2 What is your opinion on eating seaweed?
3 Do you think people will use seaweed as part of their diet in the future? Why? Why not?

Phrase hunt

13.2E Find the following expressions in the text.

1 Tuhansien vuosien ajan _____
2 joka tunnetaan yleisesti _____
3 Vaikka se muistuttaa useimpia ihmisiä
_____
4 Eittämättä, kieltämättä _____
5 ravitsemuksen näkökulmasta _____
6 on vain ajan kysymys _____

13.2F Choose the correct word for each sentence.

Seaweed is said to be surprisingly **1** **marine** / **nutritious** / **conventional**, but it might still be one of the most **2** **appetising** / **scientific** / **overlooked** foods in the world. Microalgae are 20 times more **3** **essential** / **productive** / **mouth-watering** than ordinary crops. At the moment **4** **marine** / **typical** / **superior** algae are not grown on a large scale due to its high production cost. Moreover, people are reluctant to eat food that looks like something in a **5** **delicious** / **essential** / **neglected** fish tank.

13.3

Insects

Stewart: Spider pie, anyone? Beetles and grasshoppers do not feature prominently on Western menus at the moment, but with worldwide land shortages and an increasing population that may change. Soon insect farms may be as common as chicken farms. Kirsten, what can you tell us about developments on this front?

Kirsten: First off, eating insects is much more commonplace than people realise, forming an important protein supplement for about two billion people worldwide. In Ghana, for example, termites are fried, or minced and made into bread, while in Nigeria, chocolate-coated beetles are a popular snack. In fact, beetles are the most commonly consumed insects worldwide.

Stewart: I once ate a taco with jumiles or stink bugs. They're typically eaten alive in Mexico, and having that taco was a weird experience. The bugs run into your mouth when you bite down.

Dan: What did it taste like?

Stewart: Like aniseed, with a whiff of cinnamon. Not bad, actually. Mexico has more edible species of insects than any other country in the world, but most of them are caught wild, not farmed. Could this be a problem?

Kirsten: Yes, wild-caught insect species have grown more scarce with their growing popularity. Eating an entire insect species into extinction may have terrible consequences, so insect farming is definitely the way to go.

Stewart: In general, I have to admit that cockroaches and crickets hardly strike me as mouth-watering snacks. Why are both the UN and the EU so keen on expanding insect farming, and promoting the consumption of creepy-crawlies as part of our diet?

Kirsten: Not only are many bugs rich in protein, low in fat and high in calcium and iron, but insect farms need little space. Environmentally, "micro livestock" farming beats conventional farms hands down. The creatures are far better at converting plant biomass into edible meat than even our fastest growing livestock, and they emit fewer greenhouse gases. They grow exceptionally fast and they can thrive on the waste of many industrial processes.

Dan: Getting rid of waste, both industrial and biological, is an important and often overlooked side-effect of insect farming. We feed farmed insects the waste, they breed and multiply, and are in turn consumed as food by humans, or processed as animal feed. A win-win situation.

Stewart: Healthy, green, and easy to produce. It sounds like the holy grail of farming. Why don't we see more insects on the menu?

Kirsten: I think our squeamishness is the biggest problem by far. But it's just a matter of time. In the US, a 1,200 square metre cricket farm is doing good business selling cricket powder to retailers who use it to make protein bars and flour. The same company is breeding grasshoppers in Mexico. And a Dutch insect recipe book includes delicious options like mealworm pizza and locust ravioli. It's the food of the future.

Stewart: So instead of insects biting us, we'll be biting them!

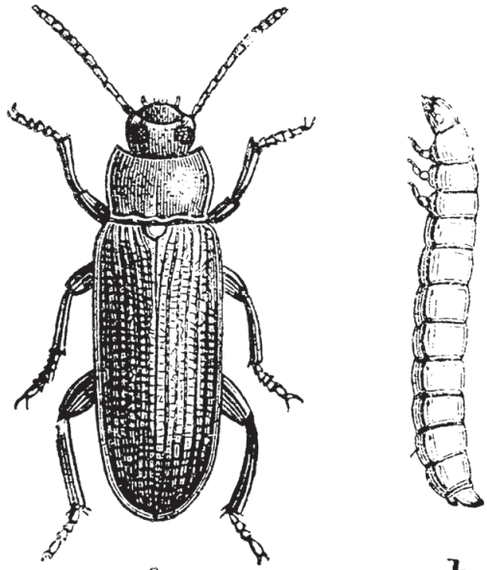
beetle /biːtl/ kovakuoriainen
grasshopper /grɑːshɒpə, græshɒpə/ heinäsirkka
feature /fiːtʃə/ olla mukana; piirre, kasvonpiirre, ominaisuus
prominently /prɒmɪnəntli/ näkyvästi
shortage /ʃɔːtɪdʒ/ puute, pula
increasing /ɪn'kriːsɪŋ/ kasvava, enenevä, lisääntyvä
first off /fɜːst ɒf/ heti aluksi, ihan aluksi
commonplace /kɒmənpleɪs/ yleinen, tavanomainen, tavallinen
supplement /sʌplɪmənt/ ravintolisä, täydennys, lisä; lisätä, täydentää
billion /bɪljən/ miljardi
termite /tɜːmaɪt/ termiitti
consume /kən'sjuːm, kən'suːm/ kuluttaa, käyttää, syödä
stink bug /stɪŋk bʌg/ typpylude
aniseed /ænəsiːd/ anis
whiff /wɪf/ häivähdys, tuulahdus, vähän jonkin makua
cinnamon /sɪnəmən/ kaneli
edible /edɪbl/ syötävä
***grow scarce** /grəu skeəs/ vähentyä, niukentua
entire /ɪn'taɪə/ koko, kokonainen
extinction /ɪk'stɪŋkʃn/ sukupuuttoon kuoleminen
consequence /kɒnsɪkwens/ seuraus
cockroach /kɒkrəutʃ/ torakka
cricket /'krɪkɪt/ sirkka
mouth-watering /ˌmauθ'wɔːtərɪŋ/ herkullinen
keen on /kiːn ɒn/ innokas
expand /ɪk'spænd/ laajentaa, levittäytyä
consumption /kən'sʌmpʃn/ kulutus, käyttö, menekki, syöminen
creepy-crawly /ˌkriːpi 'krɔːli/ ötökkä
calcium /kælsɪəm/ kalsium
iron /aɪən/ rauta
livestock /laɪvstɒk/ karja
conventional /kən'venʃənl/ tavanomainen, sovinnainen
***beat hands down** /biːt hændz daun/ peittoaa helposti, peittoaa mennen tullen
creature /kriːtʃə/ olento, olio, luontokappale
convert /kən'vɜːt/ muuttaa, muuntua, kääntyä; käännynnäinen
plant biomass /plɑːnt baɪəumæs/ kasvien biomassa
emit /ɪ'mɪt/ lähettää, päästää, luovuttaa
greenhouse gases /griːnhaus gæsɪz/ kasvihuonekaasut
exceptionally /ɪk'sepʃənəli/ poikkeuksellisen, poikkeuksellisesti
thrive on /θraɪv ɒn/ kukoistaa, elää jostakin
industrial /ɪn'dʌstrɪəl/ teollinen, teollisuus-
overlooked /ˌəuvə'lukt/ unohdettu, ei ole huomattu
side-effect /saɪd ɪ'fekt/ sivuvaikutus
***breed, bred, bred** /briːd, bred, bred/ kasvattaa, jalostaa, siittää, synnyttää
multiply /mʌltɪplaɪ/ lisääntyä, moninkertaistaa, monistaa, lisätä, kertoa
animal feed /ænɪml fiːd/ eläinten rehu
win-win situation /wɪn'wɪn ˌsɪtʃu'eɪʃn/ tilanne, josta kaikki hyötyvät
the holy grail /ðə həuli greɪl/ asia tai esine jota tavoitellaan kiivaasti, Graalin malja
squeamishness /skwiːmɪʃnɪs/ nirsoilu, herkkähermoisuus
retailer /riːteɪlə/ vähittäiskauppias, jälleenmyyjä
flour /flauə/ jauho
mealworm /miːlwɜːm/ jauhomato
locust /ləukəst/ heinäsirkka

13.3C Read the text and write notes about the key ideas in Finnish.

- hyönteisten syönti tällä hetkellä
- kokemus meksikolaisesta ötökkätacosta
- syötävät hyönteiset
- hyönteisten kasvattamisen edut
- jätteet ja hyönteiset
- hyönteisten syönti tulevaisuudessa

13.3D Answer the questions in English.

1 What are the pros and cons of using insects as a food source?
2 What is your opinion on eating insects?
3 Do you think people will use insects as part of their diet in the future? Why? Why not?



Phrase hunt

13.3E Find the following expressions in the text.

1 yhtä tavallisia kuin _____
2 Ihan aluksi _____
3 hyönteislajit ovat vähentyneet _____
4 innokkaita laajentamaan _____
5 peittoaa perinteiset farmit helposti _____
6 sen sijaan, että hyönteiset purevat meitä

_____

13.3F Choose the correct word for each sentence.

Eating insects is much more 1 **overlooked** / **mouth-watering** / **commonplace** around the world than Western people realise. Some insect species have grown more 2 **scarce** / **edible** / **wild** because of their increasing popularity. Insect farms are environmentally far better than 3 **entire** / **conventional** / **worldwide** farms. Insects thrive on both biological and 4 **healthy** / **industrial** / **overlooked** waste. A mealworm pizza may not sound particularly 5 **weird** / **holy** / **delicious**, but it is actually quite tasty.

Return to your group of three.

13G Fill in the grid together in English. Use exercise 13D to help you.

The pros and cons of future food

	articial meat	sea vegetables	insects
PROS			
CONS			

13H Teach the expressions in exercise E to your group members, who will write them down.

13I Retell the text you studied in English. Use exercise 13G to help you. Take turns.

13J Discuss the following questions in your group.

1. Which one of the future food sources mentioned in the text (artificial meat, seaweed, insects) appeals to you the most?
2. In your opinion, which one of them may become a popular food source in the future? Why?
3. What does an environmentally-friendly diet consist of?
4. What changes would you be willing to make to your diet if the products you usually eat became expensive or difficult to buy?
5. What new sources of future food can you suggest?

13K **Choose the best phrase to complete the sentences below. The phrases are taken from the phrase hunt exercise in all three co-op texts.**

beats it hands down	commonly known as
from a child's point of view	applied it to
for thousands of years	instead of
it was just a matter of time	keen on
in order to	at this point in time

Semolina storm

When a silo storing semolina (used for making pasta) burst, the wind distributed two tonnes of the flour over a town in Norfolk, England. **1** _____ clean the streets, the workmen tried to hose it away, but **2** _____ getting rid of the flour, they made the problem worse. The wet semolina swelled and became very sticky. Then **3** _____ before all roads and pavements in the town centre had to be closed to prevent accidents. **4** _____, this was great fun. "It's like walking on spaghetti!" one twelve-year-old boy said.

Bush tucker

At the Green Lizard restaurant in Sydney, chefs have taken Aboriginal recipes for preparing traditional foods from the bush, **5** _____ bush tucker in Australia, and **6** _____ the modern kitchen. Manu Thring, 21, is a junior chef there. "**7** _____," she said, "there are not many Aboriginal chefs in Australia. We have been preparing food from the bush **8** _____. We know that the quality of the bush meat is better than that of farm-reared animals. In fact, it **9** _____. Sydney restaurants are **10** _____ expanding their menus, and this is where I come in. My specialities are kangaroo steak and crocodile stew."

13L Fill in the correct preposition.

For the love of sushi

Japanese people have been eating sushi **1** _____ thousands of years. The dish has spread **2** _____ all corners of the world, and nowadays one can find sushi in restaurants from Dublin to Nairobi. **3** _____ general, most non-Japanese people associate sushi **4** _____ raw fish, but those keen **5** _____ Japanese food know that the word sushi actually refers to the sticky rice used to prepare the delicious dishes. According **6** _____ chef Masa Nozawa, raw slices of fish served without rice are called sashimi. Tuna is often used **7** _____ sashimi since most Japanese sushi chefs consider raw tuna to be superior **8** _____ all other kinds of fish. But tuna is becoming increasingly rare and expensive. Recently, a restaurant owner paid $1.76 million for a rare bluefin tuna at the Tokyo fishmarket, for example. The hunt **9** _____ a tuna substitute that would satisfy picky Japanese customers is on. Instead **10** _____ using tuna, many sushi chefs have turned to salmon.

13M Choose an idiom to replace the expression in colour.

1 Passing the exam was **totally easy** because I spent a lot of time studying last week.
a) the cream of the crop
b) in the soup
c) a piece of cake

2 The teacher said that the boy at the back of the classroom was **her favourite**.
a) polishing the apple
b) a piece of cake
c) the apple of her eye

3 She was **very calm** during the interview.
a) as cool as a cucumber
b) full of beans
c) the cream of the crop

4 It is not really **something that appeals to me**, but if you want I will go with you.
a) my duck soup
b) my cup of tea
c) my gravy train

5 He is always trying to **flatter** his boss in order to get a raise.
a) carrot and stick
b) butter up
c) bread and butter

6 The new spirulina products have been **selling very rapidly**.
a) upsetting the applecart
b) worth their salt
c) selling like hotcakes

13N Choose task A, B, C or D. Write about 150–250 words.

A Bugs for dinner? Write a speech in which you either promote or discourage the consumption of edible insects.

B With the growing world population, we might soon face a global food shortage, especially concerning meat. How can we deal with this problem?

C You are interested in trying out exotic foods. Write about some of your experiences.

D Look at the poems on p. 141. Write your response to one of the poems. Your response can be a poem or an email to the poet.

Topic 14

On the move

I'm really looking forward to a time when generations after us look back and say how ridiculous it was that humans were driving cars.
(Sebastian Thrun, American computer scientist)

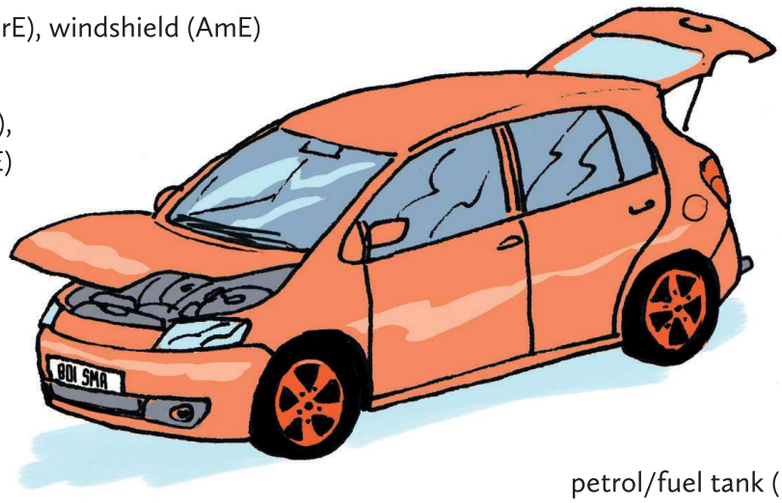
14A **Label the car using the following words.**

boot (BrE), trunk (AmE)

bonnet (BrE), hood (AmE)

windscreen (BrE), windshield (AmE)

windscreen wiper (BrE), windshield wiper (AmE)



exhaust pipe

headlight

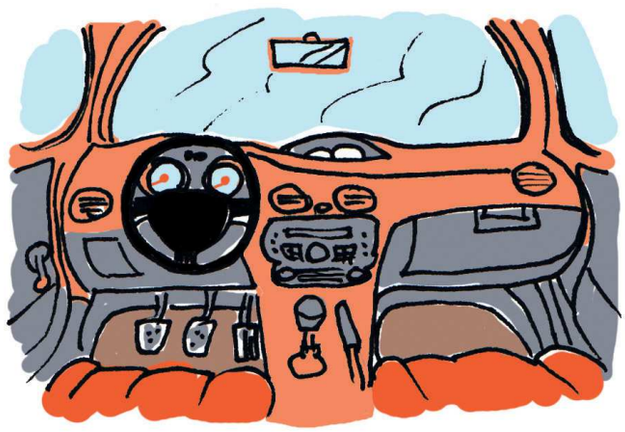
bumper

number plate (BrE), license plate (AmE)

petrol/fuel tank (BrE), gas tank (AmE)

indicator (BrE), turn signal AmE)

steering wheel



dashboard (BrE)

speedometer

horn

glove compartment (BrE), glove box (AmE)

accelerator (BrE), gas pedal (AmE)

handbrake (BrE), emergency brake (AmE)

brake

clutch

gear lever (BrE), gear shift (AmE)

14B While listening to the sketch about driving, write down the following vocabulary in English. Work in pairs.

1 varo _____

2 hiljennä _____

3 nopeusrajoitus _____

4 väärä vaihde _____

5 35 mailia tunnissa _____

6 suojatie _____

7 ylittää tie _____

8 näyttää suuntamerkkiä _____

9 vaihtaa kaistaa _____

10 kiihdyttää liikennevaloissa _____

14C Discuss the following car-related questions in small groups.

- Should moped cars be banned from Finnish roads?
- What should be the minimum age to get a driver's licence? Should it be different in the countryside?
- Statistics show that young women have fewer accidents than young men. Should the minimum age for men to get a driver's licence be higher than for women?
- Should there be a maximum age for driving a car?
- Are you worried about the pollution that cars produce?
- What do you think of motor sports like Formula One or rally?
- What are some of the reasons for not getting a driving licence?
- What are some of the reasons for not owning a car?
- What do you think of car sharing and car pooling?

car pooling kimppakyyti

Personal dictionary

14D **Read text 14. Find the words below in the text and underline them.**

- First, guess the meaning, then look them up in the vocabulary app if necessary and write them down on p. 167.
- Choose 3–5 extra words and mark them, too.
- Try making sentences with some of the words.

1 substandard
2 perception
3 summon
4 livelihood
5 uproot
6 infancy
7 awe-inspiring
8 outlaw

Topic 14 Key text

Driverless cars

The car's weakest link is the driver

As car components go, human beings are deeply substandard – we have imperfect perception, we are easily distracted, we are ruled by emotion, and we vary wildly in quality. No surprise then that billions of dollars are being spent on developing a driverless car. The hope is that autonomous vehicles will not only end car crashes, but that they will also improve traffic flow, reduce energy consumption, and cut levels of air pollution.

It will be good for our stress levels, too. Few people enjoy navigating crowded freeways or city streets during the rush hour. It will also be good for our wallets too, since the cost of travel will fall dramatically: one robot car can be shared by a number of owners who could summon it whenever they needed to go somewhere.

Of course, there are concerns about driverless cars. What will happen to the livelihoods of professional drivers? Taxi drivers, lorry drivers, bus drivers would all find themselves out of a job. And who will be responsible when an accident occurs? And what if someone hacks into the software controlling our car? All legitimate concerns, but they shouldn't distract us from the inevitable: sooner or later a digital chauffeur will be handling all our day-to-day driving. In fact, insisting on driving a car ourselves might one day be considered reckless behavior.

In her article "Driverless Cars Are Like Elevators", the American journalist Adrienne Lafrance looks back at technological developments in the past and finds a parallel for today's invention.

Driverless Cars Are Like Elevators

Just another magic box with buttons in it

by Adrienne Lafrance

One of the challenges in describing the potential of self-driving cars is that they promise to do so much. Technologies that save lives, decimate and create entire industries, and uproot long-held perceptions of space and time don't come around very often.

Which is part of why it can be useful to try to think about driverless cars in the context of technological revolutions of the past. If this moment in technological history is indeed pivotal, which other transformative moment in technological history is it most like?

In the past few months, I've posed this question to dozens of engineers, scholars, and executives who are focused on self-driving cars. Three answers came up repeatedly.

Who's driving the car?

The first two answers aren't all that surprising: The dawn of self-driving cars reminds a lot of people of a time when the original automobiles were in their infancy. Airplanes, too. ("When I rode in the Google car last summer, I felt like I was at Kitty Hawk," the Massachusetts Institute of Technology engineering professor John Leonard told me, referring to the site of the Wright brothers' famous airplane test flights in 1903.)

The third response was a bit more unusual. "Another related technology, in a lot of ways, is the elevator," said Chris Urmson, the head of Google's self-driving-car project. "It's another technology that had a fairly profound impact on cities."

Urmson's not the only one to make this comparison. Elon Musk, the CEO of Tesla, has compared driverless cars to elevators, too.

Elevators didn't just change people's perceptions, they changed how humans physically move through buildings and cities. Whereas it was once more desirable to live and work closer to the ground – as someone who once lived on the seventh floor of a walk-up in New York, I know this to be true – elevators made higher floors more desirable.

Elevators also enabled architects to build up, up, up. The vertical aesthetic of the modern city, skyscraper-dotted horizons that double as distinct urban signatures, exist because of elevators. They created a new, and often socially awkward, kind of public space – one that feels simultaneously intimate, fleeting, and unpredictable, even as passengers know exactly where they are going.

And elevators themselves have changed over time, as The Boston Globe pointed out last year: "Trained operators armed with cranks and levers have been replaced with buttons; motion sensors have made holding the door less of a heroic act."

It's no mistake that Urmson and Musk, both of whom are dedicated to bringing driverless cars to the masses, would offer a comparison that highlights acutely how technological change and cultural change intersect – and, more specifically, how quickly a technology can go from seeming extraordinary to mundane.

→

"There's another really interesting parallel in the way they were introduced," Urmson told me. "The technology was this magic thing that would whisk you up floors. You couldn't possibly imagine relinquishing your life to this thing. So it was people's job to sit in the elevator and press the button for you – because it was so complicated. People grew accustomed to it, and they realized they didn't really need the person there to press the button."

In other words, the message is, if you've ever taken for granted an elevator, perhaps someday a self-driving car will be similarly ho-hum. Just another box you climb into, with buttons to press. It used to be awe-inspiring but isn't anymore.

If and when that happens, people are likely to see human-driven cars differently, too. "People may outlaw driving cars because it's too dangerous," Musk said at a developer's conference in California earlier this year. "You can't have a person driving a two-ton death machine."

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The first elevators – mystery, magic and panic.

substandard /sʌb'stændəd/

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perception /pə'sepʃn/

***be distracted** /biː dɪ'stræktɪd/ olla häiritty, huomio kiinnittynyt muualle
vary /veəri/ vaihdella, muuttua
driverless car /draɪvələs kɑː/ robottiauto
autonomous /ɔː'tɒnəməs/ itseohjautuva, autonominen, itsehallinnollinen
vehicle /viːɪkl/ kulkuneuvo, auto
car crash /kɑː(r) kræʃ/ auto-onnettomuus
improve /ɪm'pruːv/ parantaa, kohentaa
flow /fləu/ virta; virrata
reduce /rɪ'djuːs, rɪ'duːs/ vähentää, laskea
consumption /kən'sʌmpʃn/ kulutus, kuluttaminen
air pollution /eə(r) pə'luːʃn/ ilmansaaste
crowded /kraudɪd/ täpötäysi
freeway /friːweɪ/ moottoritie
summon /sʌmən/

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concern /kən'sɜːn/ huoli; herättää huolta, koskea
livelihood /laɪvlɪhud/

---

occur /ə'kɜː/ tapahtua, juolahtaa mieleen
hack /hæk/ hakkeroida; hakkerointi
software /'sɒftˌweə, sɔːftweə/ tietokoneohjelma
legitimate /lɪ'dʒɪtɪmɪt/ pätevä, laillinen, oikeudenmukainen
distract /dɪ'strækt/ harhauttaa, kääntää ajatukset pois
inevitable /ɪn'evɪtəbl/ vääjäämätön, ennustettava, ennalta arvattava
chauffeur /ʃəufɜː, ʃəu'fɜː/ kuljettaja; kuljettaa
day-to-day /ˌdeɪtə'deɪ/ päivittäinen, joka-päiväinen; päivittäin
insist on /ɪn'sɪst ɔn/ vaatia
reckless /rekləs/ harkitsematon, edesvastuuton, uhkarohkea
look back /luk bæk/ muistella
technological /ˌteknə'lɒdʒɪkl/ teknologinen, tekninen
parallel /pærəlel/ vertailukohta, vastaavuus; rinnakkainen, samansuuntainen; rinnastaa
challenge /tʃælɪndʒ/ haaste; haastaa
decimate /desɪmeɪt/ hävittää, tuhota
uproot /ʌp'ruːt/

***come around** /kʌm ə'raund/ tapahtua; muuttaa mieltään
revolution /ˌrevə'luːʃn/ mullistus, kumous, vallankumous
indeed /ɪn'diːd/ aivan; todella, todellakin
pivotal /pɪvətl/ käänteentekevä, keskeinen
transformative /træns'fɔːmətɪv/ muutos-, muutoksellinen
pose a question /pəus ə 'kwestʃən/ esittää kysymys
scholar /skɒlə/ tutkija, oppinut
executive /ɪg'zekjutɪv/ johtaja, toimitusjohtaja, johtohenkilö; toimeenpaneva
repeatedly /rɪ'piːtɪdli/ toistuvasti, useasti
dawn /dɔːn/ sarastus, auringonnousu, alku; sarastaa, valjeta
remind of /rɪ'maɪnd əv/ muistuttaa jstak
infancy /ɪnfənsi/

---

refer to /rɪ'fɜː tu/ viitata johonkin
profound /prə'faund/ syvä, syvällinen, perusteellinen
impact on /ɪmpækt ɔn/ vaikutus jhk
comparison /kəm'pærɪsn/ vertailu, vertaus
desirable /dɪ'zaɪərəbl/ haluttu, toivottu, tavoiteltava
walk-up /wɔːkʌp/ asunto/kerrostalo, jossa ei ole hissiä
enable /ɪn'eɪbl/ sallia, tehdä mahdolliseksi, mahdollistaa
vertical /vɜːtɪkl/ pystysuora, pystysuuntainen
aesthetic /iːs'θetɪk/ estetiikka; esteettinen
skyscraper-dotted /skaɪskreɪpə dɒtɪd/ pilvenpiirtäjien täplittämä
distinct /dɪ'stɪŋkt/ selvästi erotettava, selkeä
awkward /ɔːkwəd/ hankala, kiusallinen
simultaneously /ˌsɪməl'teɪnɪəsli/ samanaikaisesti, samalla
intimate /ɪntɪmət/ henkilökohtainen, yksityinen
fleeting /fliːtɪŋ/ hetkellinen, ohikiitävä
unpredictable /ˌʌnprɪ'dɪktəbl/ ennustamaton, arvaamaton
operator /ɒpəreɪtə/ kuljettaja, koneenkäyttäjä, toimija
armed /ɑːmd/ varustettu, aseistettu
crank /kræŋk/ kampi

lever /liːvə/ vipu
dedicate /dedɪkeɪt/ omistautua
highlight /haɪlaɪt/ painottaa; korostus
acutely /əˈkjuːtli/ akuutisti, kovasti, vakavasti, kriittisesti
intersect /ˌɪntəˈsekt/ ristetä, kulkea ristiin jnk kanssa
extraordinary /ɪkˈstrɔːdənri; ɪkˈstrɔːdəneri/ erikoinen, kummallinen, omituinen
mundane /ˌmʌnˈdeɪn/ tavanomainen, tylsä
whisk /wɪsk/ kiidättää, vispata, pyyhkiä; pyyhkäisy
relinquish /rɪˈlɪŋkwiʃ/ luovuttaa, luopua
accustomed /əˈkʌstəmd/ tottunut
***take for granted** /teɪk fə grɑːntɪd, græntɪd/ pitää itsestään selvänä
ho-hum /ˈhəuˈhʌm/ tylsä, mielenkiinnoton
awe-inspiring /ɔːɪnspaɪərɪŋ/

---

outlaw /autlɔː/

---

motion sensor /ˈməuʃn ˈsensə(r)/ liiketunnistin

14E After reading the text, choose the alternative that is closest to the text.

The car's weakest link is the driver

1 Why do we spend large sums of money on developing driverless cars?
a) To improve the quality of cars.
b) Because people's emotions interfere with their driving.
c) To reduce traffic flow.

2 Driverless cars will be cheaper because
a) they reduce our stress levels.
b) they offer opportunities for car sharing.
c) few people enjoy navigating crowded freeways.

3 One concern about driverless cars is that
a) a digital driver is unreliable.
b) they may cause unemployment.
c) a digital driver may handle the day-to-day driving.

Just another magic box with buttons in it

4 Why is it difficult to describe the possibilities offered by driverless cars?
a) Most of these possibilities are unrealistic.
b) We perceive these possibilities differently depending on where we live.
c) There are so many possibilities.

5 Why is the development of driverless cars compared to the time when the first automobiles arrived?
a) The writer claims that this was also a moment when technology dramatically changed our lives.
b) Original automobiles were also expensive.
c) Because when she rode in the Google car she felt like Kitty Hawk.

6 Elevators used to be
   a) pleasant places.
   b) low-tech machines.
   c) controlled by an operator.

7 According to the text, why do modern passengers operate the lifts for themselves?
   a) It saves money.
   b) They no longer need the reassurance of having an operator.
   c) Motion sensors are more reliable.

8 The message of the article is that
   a) in the future self-driving cars may become as commonplace as elevators.
   b) people will continue to drive cars in the future.
   c) outlaws will make driving cars dangerous.

14F **In pairs, decide which one of you is A and B (turn to page 187). Cover the other half. Take turns reading your sentences to your partner who will write them down. Check the spelling and translate them into Finnish.**

	A Pros	B Cons
1	Driverless cars will end car crashes.	
2	They will improve traffic flow.	
3	They will reduce energy consumption.	
4	They will cut levels of air pollution.	
5	The cost of travel will fall dramatically.	

- Can you think of any other pros and cons that are not mentioned in the text?

Phrase hunt

14G **Find the following expressions in the text.**

1 tunteet ohjaavat meitä _____

2 Viimeisen parin kuukauden aikana _____

3 muistuttaa monia ihmisiä ajasta, jolloin

_____

4 hiukan epätavallisempi _____

5 oli melko syvällinen vaikutus kaupunkeihin

_____

6 asui seitsemännessä kerroksessa _____

7 on olemassa hissien takia _____

8 sankarillinen teko _____

9 joista molemmat _____

10 Se oli ennen kunnioitusta herättävä

_____

Traffic jam from the last century.

14H Fill in the gaps by using phrases from exercise 14G.

1 I really enjoyed the view from our New York apartment.
We _____.

2 The dawn of self-driving cars _____
the first automobiles were developed.

3 She had two sons, _____ were taxi drivers.

4 He bought a self-driving car. _____ he has
forgotten how to drive.

5 Since _____,
we sometimes make poor decisions.

6 She pulled the driver from the burning car, and was later thanked for
her _____.

7 Skyscrapers _____.
Who would want to walk up all those stairs?

8 Looking for something _____?
Try touring Ireland in a horse-drawn caravan.

14I Add another synonym to the list. All the words you need appear in the box. Note that there are three extra words.

reduce	autonomous	substandard	dawn
legitimate	increase	awe-inspiring	distract

1 self-governing, independent, free, self-ruling, _____

2 breathtaking, amazing, stunning, awesome, _____

3 beginning, early days, early stage, launch, _____

4 lessen, lower, decrease, diminish, _____

5 inferior, second-rate, poor-quality, imperfect, _____

14J **In pairs decide who is A and B. Explain the following words and sayings to your partner in English. Then write sentences that include the words.**

A

scholar
invention
pivotal
have an impact on
skyscraper
take for granted

B

vehicle
outlaw
revolution
make a comparison
motion sensor
consumption

14K **Here is a grid with some words from the vocabulary list. Work with your partner and add twelve more words that you find challenging.**

- Then take turns making sentences that use the words. Each sentence should include two words from the grid. They can come from any part of the grid.
- After each sentence, cross the words out. Keep going until all the words on the grid have been used.

Tip: Try to make long sentences as this is good practice for your English.
Example: I set out at dawn on an extraordinary trip from Pori to Beijing.

awkward	double		reduce
challenge		livelihood	
crash	extraordinary		refer to
	freeway		remind
dawn		pollution	
	highlight		technology
describe		reckless	

14L What is the Hyperloop? Listen to the text and answer the questions in Finnish.

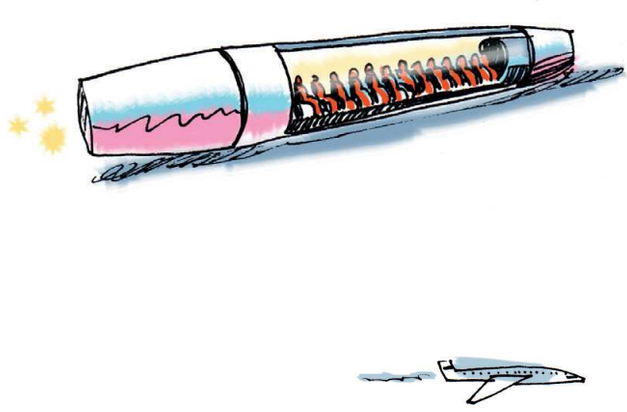
Travel by Hyperloop

At the moment, when we want to travel long distances rapidly, we go by air. The problem with airplanes is that they require huge amounts of energy, pollute the atmosphere, and contribute to global warming. Is there a more sustainable way of transporting large amounts of people and goods? The billionaire entrepreneur Elon Musk thinks he has an answer: the Hyperloop, a land-based transportation system capable of moving passengers distances of 900 miles in around 90 minutes.

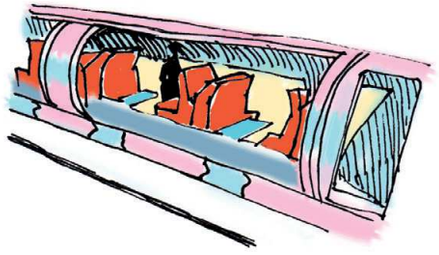
Here, to explain the idea, is transport engineer, Fiona McKenzie.

1

2



3



4

1 Miksi putkijuna kulkee niin nopeasti?
2 Miksi putkijuna on ympäristöystävällinen?
3 Miten putkijuna kulkee raiteilla ja kuinka se pysähtyy?
4 Mitä etuja putkijunalla on? Mainitse kaksi asiaa.

No risk of parallel parking.

14M **Project. In small groups, design your dream car. Do some research online and draw a car that you will be using in 2026.**

- Label the parts of the car.
- Write a description of your future car. What advantages does it have over today's cars?
- Present your work to the class.

14N **Write an online article of 150–250 words on one of the following topics.**

1 I would/would not choose a driverless car because...
2 My first trip on the Hyperloop.
3 My future invention.

Topic 15

Pronunciation

Impossible is not a scientific term.
(Vanna Bonta, American writer, actress and inventor)

Sentence rhythm

English is a very rhythmical language, and the rhythm produced by a combination of stressed and unstressed syllables is a major characteristic of spoken English. Sentence stress is an important factor in fluency, and helps a listener understand what elements are important in a sentence.

15A Listen to the following sentence read in a variety of ways.

A red apple fell on Newton's head.

Each time a different word is stressed, the meaning of the sentence changes slightly. Write the corresponding number next to the implied meaning as you listen to the sentences. The first one has been done for you.

- The focus is on the type of fruit. An apple, not a banana. ☐
- What kind of apple was it? 1
- Where did that apple fall? On his head, not on any other part of his body. ☐
- On Newton's, not on anybody else's head. ☐
- The focus here is on how the apple got to his head – nobody threw it at him. It fell. ☐

15B An ABC of basic science words. Work in pairs. First listen to how the words are pronounced. Then take turns reading the words aloud.

1	accelerate – acceleration	11	friction
2	accurate – accuracy	12	molecule
3	asteroid	13	nuclear fission
4	astronomy	14	pathogen
5	cellular	15	permeate
6	chemistry – chemical	16	philosophy
7	cohesion	17	photosynthesis
8	combust – combustion	18	psychology
9	equate – equation	19	radiate – radiation
10	evaporate – evaporation	20	soluble

15C **Work in pairs. First choose and underline the correct scientific word. Take turns reading the sentences aloud, paying particular attention to rhythm and stress. Finally, listen and check your answers.**

1 Sports commentators will sometimes say that an athlete is **accelerating** / **acceleration**. Yet **accelerate** / **acceleration** has nothing to do with going fast. It would be more **accurate** / **accurately** to say that it is about going *faster*.

2 Scientifically speaking, **photosynthesis** / **photography** is the process whereby green plants use energy from the sun to synthesize sugar from carbon dioxide and water.

3 Resembling giant rocks, **astronomy** / **asteroids** are sometimes called minor planets. The word comes from the Greek, meaning "star-like" and some **asteroids** / **astronomers** behave as if they are rock stars.

4 I think ultrasounds are safer than X-rays because they use sound waves instead of **radiation** / **radios**.

5 This type of poison is not **dissolve** / **soluble** in water, but it will dissolve in alcohol. However, since alcohol **evaporates** / **permeates** faster than water at any temperature below boiling point, you would have to work fast to get rid of the poison.

6 Our current value system **equates** / **radiates** money with success. If we take money out of the **permeation** / **equation**, being successful could basically mean being happy.

7 The main process for generating nuclear energy is called nuclear **friction** / **fission**. **Fission** / **Friction** is what we experience in my family when we start arguing over the use of nuclear energy.

8 In **chemistry** / **a chemist**, a **mole** / **molecule** is defined as a combination of two or more atoms held together by **chemical** / **chemistry** bonds.

"What did the officer molecule say to the suspect molecule?
"I've got my ION you."

15D **Listen to the words. Check that you know the meaning of the words in Finnish. Use your vocabulary app if you need to. Fill in the gaps.**

friction cohesion photosynthesis cell combustion permeate pathogen

1 I know that a _____ is the basic structural, functional, and biological unit of all known living organisms.

2 _____ is what happens when particles of the same substance stick together.

3 _____ is an interesting word. Technically, it's what happens when one thing rubs against another.

4 _____ is a process whereby green plants and other organisms use sunlight to synthesize foods from carbon dioxide and water. Oxygen is generated as a byproduct.

5 _____ is a chemical process in which a substance reacts rapidly with oxygen and gives off heat.

6 A _____ is any small organism, such as a virus or a bacterium, that can cause a disease.

7 The bad odour from the leather factory _____ the entire town. You could smell it everywhere. It was pretty disgusting.

In pairs, take turns reading the sentences aloud paying particular attention to pronunciation.

Topic 16

Read on

It suddenly struck me that that tiny pea, pretty and blue,
was the Earth. I put up my thumb and shut one eye,
and my thumb blotted out the planet Earth.
I didn't feel like a giant. I felt very, very small.
(Neil Armstrong, American astronaut)

Topic 16

Out among the stars

The poetry of technology

by Lewiesa

Thanks Galileo, for looking up there:
(the mountains of the moon,
the Milky Way, suns, stars
and everything dark and distant).

Thanks Van Leeuwenhoek,* for looking down here:
(the eye of a fly, spiky details of ice,
drops of blood, heart of a flower
and all that pulses with life).

Thanks to the sand that
made the glass
that makes us see
the life in the grain of sand.

Protons, neutrons, electrons, atoms
a swirling up and out,
here and there and everywhere,
on earth as it is in heaven.

We are all connected.

© *Lewiesa*

*Anton van Leeuwenhoek (1632–1723)
Considered as the father of microbiology. Known also for developing and improving microscopes.

Milky Way /ˈmɪlki weɪ/ Linnunrata
fly /flaɪ/ kärpänen; lentää
spiky /ˈspaɪki/ piikikäs, piikkinen
drop /drɒp/ pisara, tippa; pudota, pisaroida
pulse /pʌls/ sykkiä; pulssi, syke
grain /greɪn/ jyvä, vilja
proton /ˈprəutɒn/ protoni
neutron /ˈnjuːtrɒn/ neutroni
electron /ɪˈlektrɒn/ elektroni
atom /ˈætəm/ atomi
swirl /swɜːl/ kieppua, pyörteillä; pyörre, kierre

16A Choose the correct alternative, and, working with a partner, do questions 3, 4 and 5 in English.

1 What is the atmosphere like in the poem? Choose the most correct alternative.
   a) Melancholic and sad. The poet thinks that the earth is a place consisting of disconnected items.
   b) Grateful and appreciative. The poet appreciates everything around us.
   c) Scientific. The poet considers earth from a purely scientific point of view.

2 What is the most important theme in the poem?
   a) Everything, no matter how big or how small, is connected.
   b) We have to appreciate scientists.
   c) There is a close connection between neutrons, sand and glass.

3 Which stanza of the poem do you like the best? Why?

4 Choose your own title for the poem. Explain your choice to your partner.

5 If you were to write a similar poem, which two scientists would you choose to have in your poem? Why? Which small and large things in the world do you think are worth mentioning in a poem? Write them down in English. Compare your sentences in pairs or groups.

When I heard the learned astronomer

by Walt Whitman (1819–1892)

When I heard the learned astronomer,
When the proofs, the figures, were ranged in columns before me,
When I was shown the charts and diagrams, to add, divide, and measure them,
When I sitting heard the astronomer
where he lectured with much applause in the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wandered off by myself,
In the mystical moist night-air, and from time to time,
Looked up in perfect silence at the stars.

© *Walt Whitman*

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learned /lɜːnɪd/ oppinut
astronomer /əˈstrɒnəmə/ astronomi, tähtitieteilijä
proof /pruːf/ todiste, todisteet, todistus
figure /fɪgə, fɪgjə/ luku, numero, kuvio, kaavio
range /reɪndʒ/ lajitella, ryhmittää; joukko, valikoima, vuoristo
column /kɒləm/ sarake, palsta, pylväs
before /bɪˈfɔː/ edessä, ennen, aikaisemmin
chart /tʃɑːt/ kaavio, taulukko; kartoittaa
diagram /daɪəgræm/ diagrammi, graafinen esitys, kaavio, kaavakuva
add /æd/ laskea yhteen, lisätä
divide /dɪˈvaɪd/ jakaa, jakautua, jaotella
measure /meʒə/ mitata; mitta, määrä, toimenpide
lecture /lektʃə/ luennoida; luento
applause /əˈplɔːz/ aplodit, suosionosoitukset; taputtaa
lecture-room /lektʃə ruːm/ luentosali
unaccountable /ˌʌnəˈkauntəbl/ vastuuton, käsittämätön, selittämätön
***rise, rose, risen** /raiz, rəuz, rizən/ nousta, kohottautua, kohota, yletä; nousu, kohoaminen
glide /glaɪd/ liitää, liukua; liitäminen, liito
wander off /wɒndər ɒf/ harhautua, kierrellä, eksyä
mystical /mɪstɪkl/ mystinen
moist /mɔɪst/ kostea, nihkeä

16B Answer the questions in English.

1 In what two locations does the poem take place?

2 What happens in the poem?

3 The poet makes use of contrasts to get his message across. Read the poem again, and fill in the gaps. The first one has been done for you.

a) In the lecture-room, a crowd is listening to the astronomer. This is contrasted with the poet who wanders off by himself.

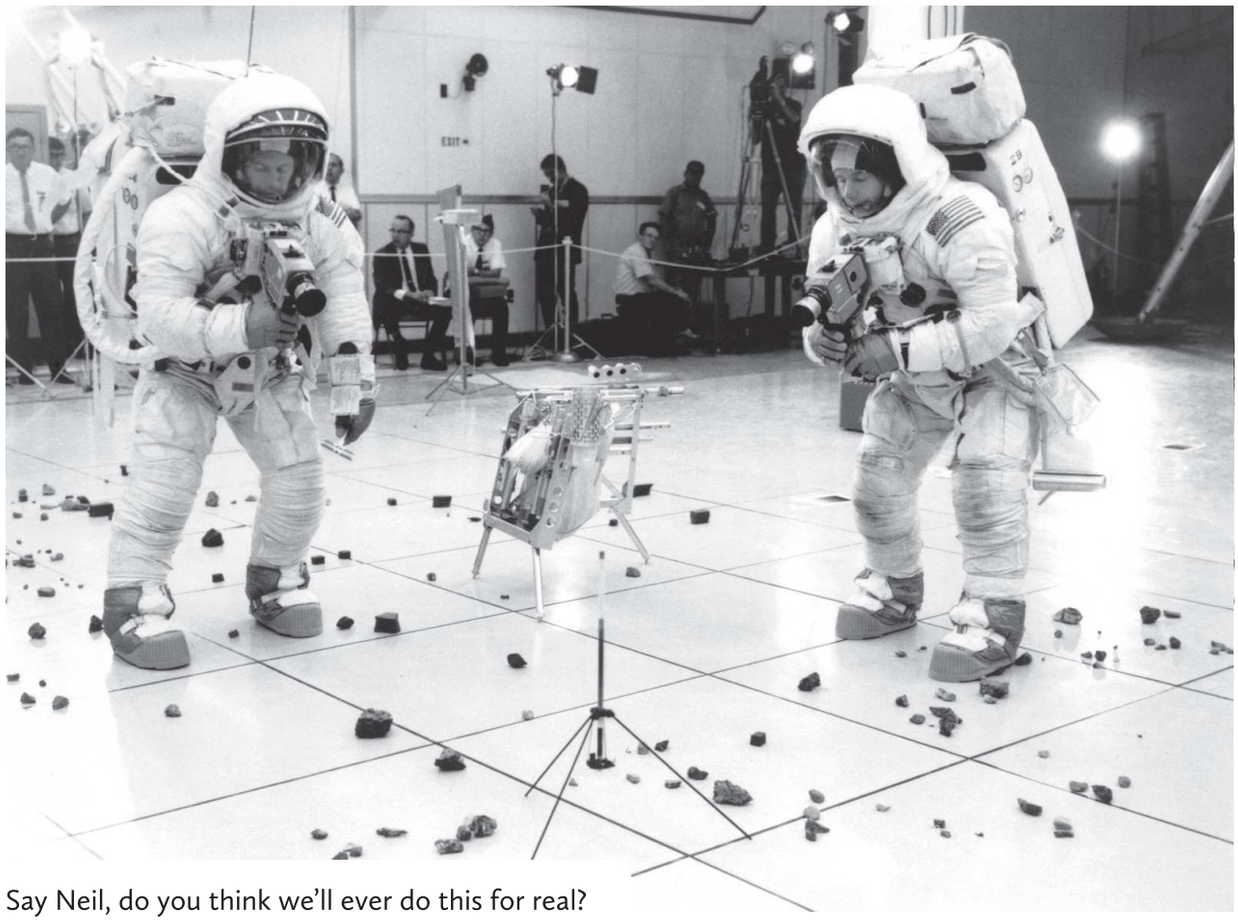
b) The astronomer is talking, the people are applauding. This is contrasted with

_____

c) The charts, diagrams, figures and columns about the stars are contrasted with

_____

4 What do you think is the overall message of this poem?



Say Neil, do you think we'll ever do this for real?

16C **Read the following quotes about maths and science. Choose two or three. Discuss with a partner what you think the quote means, and whether you agree or disagree with it.**
OR
Choose three quotes and rewrite them to reflect your own thinking.

- Maths is the only subject that counts. *(Anonymous)*
- Science is a wonderful thing if one does not have to earn one's living at it. *(Albert Einstein)*
- Science is always wrong. It never solves a problem without creating ten more. *(George Bernard Shaw)*
- But in science the credit goes to the man who convinces the world, not to the man to whom the idea first occurs. *(Francis Darwin)*
- Politics is more difficult than physics. *(Albert Einstein)*

16D **Many artists have taken science, technology or medicine as the subject of their work. Go online and find an artistic text that has a scientific or technological theme.**

It could be

- a poem,
- an extract from a novel or a play,
- a quote, or
- the lyrics of a song.

Work in small groups. Present your choice. You may mention some of the following points when explaining your choice

- the type of text you chose,
- who wrote it,
- why you chose it,
- the aspect of science or technology it focuses on,
- the attitude the writer of the text has towards the subject and how this is communicated.

After the discussion, choose which texts interested you the most and why.

HOW TO

How to recite poems

1 Slow down. When you read at a slower pace, the poem will be easier to hear. The poet has chosen each word carefully; every word is important and needs to be heard. A poem cannot be read too slowly, and a good way for a reader to set an easy pace is to pause for a few seconds between the title and the poem's first line.

2 Read in a normal, relaxed tone of voice. It is not necessary to give any of these poems a dramatic reading as if from a stage. Let the words of the poem do the work. Just speak clearly and slowly.

3 Obviously, poems come in lines, but pausing at the end of every line will create a choppy effect and interrupt the flow of the poem's sense. Pause only where there is punctuation, such as a comma or full stop, just as you would when reading prose, only more slowly.

16E Choose task A, B or C.

A Write a poem in the spirit of either Walt Whitman or Lewiesa. Choose the content from your own experience.

B Write a prose poem about a scientist or an inventor that has made it possible for you to enjoy life more.

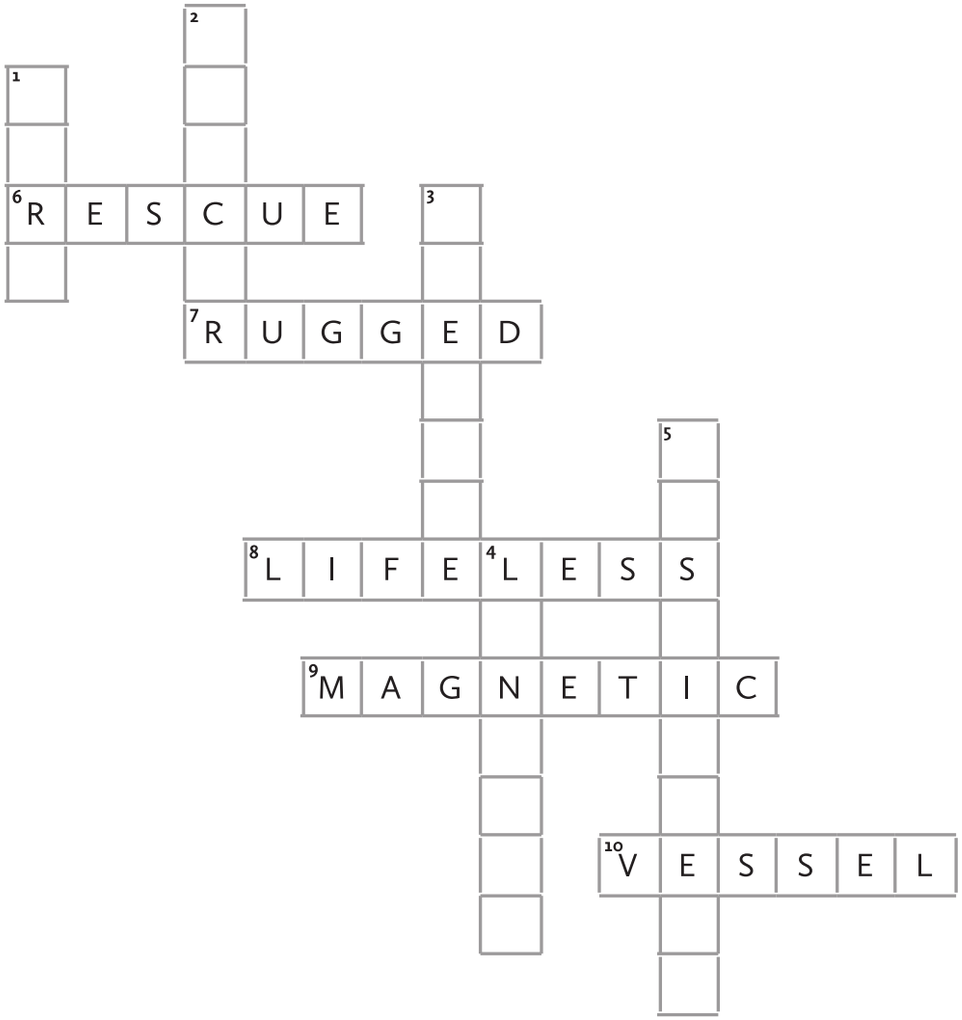
C You have volunteered to join a mission on Mars. You will probably never return to earth again. The evening before you depart, you sit down to write a letter to yourself to remind you of all the beautiful things on earth. Write 150–250 words. Begin like this:

Dear _____ (your name)
I write this to remind you...

See the online *How to write* section for help and detailed instructions.

1I Talking crossword. You and your partner both have the same crossword but half of the words are missing in each version. Give each other clues to fill in the missing words.

Student A: Turn to page 20.
Student B: Use the crossword on this page.



14F In pairs, decide which one of you is A and B (turn to page 169). Cover the other half. Take turns reading your sentences to your partner who will write them down. Check the spelling and translate them into Finnish.

	A Pros	B Cons
1		Chauffeurs will lose their jobs.
2		Who is responsible for an accident?
3		Someone may hack into the software controlling the car.
4		People who enjoy driving may not be allowed to drive their cars.
5		We lose our sense of space and time.

- Can you think of any other pros and cons that are not mentioned in the text?

Relatiivipronominit · Relative pronouns

Listen and fill in the missing relative pronouns.
Underline the words they refer to.

1 Neil Armstrong, _____ was born in 1930, was the first person to stand on the Moon.

2 Apollo 11, _____ was the name of the spacecraft, took the first people to the Moon.

3 The flight was a success, _____ was a relief to NASA.

4 The spacesuits _____ were worn by the Apollo 11 astronauts are now in a museum.

5 _____ NASA achieved on that day has inspired millions of people all over the world.

- Englannin kielen yleisimmät relatiivipronominit ovat **who**, **which**, **that**.

1	who	joka, jotka	viittaa ihmisiin
2	which	joka, mikä	viittaa asioihin, esineisiin tai eläimiin, tai koko edeltävään lauseeseen
3	that	joka, jotka	viittaa sekä asioihin että ihmisiin

- **Korrelaatti** on asia, johon relatiivipronominilla viitataan.

Korrelaatti	relatiivipronomini
The boy	**who** bought the huge telescope is my cousin.
	relatiivilause

- **What** (se, mikä) sisältää korrelaatin, eikä siis viittaa edellä olevaan sanaan tai lauseeseen.

  What I would like to do, is go to the Moon.

WHO joka, jotka

- **who** viittaa ihmisiin ja voi olla yksikkö tai monikko.

  Neil Armstrong, **who** was born in 1930, was the first human being to stand on the Moon.

- **whose** (*jonka*, *joiden*) on omistusmuoto.

  He was accompanied by another astronaut, **whose** name was Buzz Aldrin.

- **whose** voi viitata myös asioihin ja esineisiin.

  The exploration of the Moon, **whose** surface area is roughly that of North and South America combined, has continued ever since.

- **prepositio** tulee yleensä **lauseen loppuun**.

  Did you see the man **who** she was talking **to**?

- Muotoa **whom** käytetään preposition jälkeen, ja se on hyvin muodollinen.

  Did you see the man **to whom** he was talking?

WHICH joka, jotka; mikä

- **which** viittaa **asioihin ja esineisiin** ja voi olla yksikkö tai monikko.
  Mars has two moons, Phobos and Deimos, **which** are small and irregularly shaped.
- **which** voi viitata myös **koko edeltävään lauseeseen**. Huomaa, että tällöin tulee aina pilkku.
  Only 18 missions to Mars have been successful, **which** is surprising.
- **which**-pronominiin voi liittyä myös **prepositio**. Se laitetaan yleensä loppuun.
  The planet **which** I am interested **in** is Venus.
- Omistusmuotona käytetään **whose**-pronominia.
  The planet Venus, **whose** name refers to a Roman goddess, is our closest neighbour.
- Omistamisen voi ilmaista myös muodollisemmin: **pääsana + *of which/whom***
  The planet Venus, **the name of which** refers to a Roman goddess, is our closest neighbour.

THAT joka, jotka

- **that** viittaa sekä ihmisiin, asioihin ja esineisiin. Se on yksikkö tai monikko, ja sitä voi käyttää usein *who* ja *which* -pronominien sijaan.
  I saw a robot **that** / **which** / **who** acted like a human being!

Sitä käytetään, jos korrelaattina on

- all, much, little — There is very **little** **that** you can do about it.
- thing-loppuinen pronomini — Is there **something** **that** I should know?
- superlatiivi tai järjestysluku — **The best answer** **that** I got was yes.
- first, last, only — Who was **the first person** **that** landed on the Moon?

Huomaa:
That-pronominin **eteen ei** tule koskaan **pilkkua** eikä prepositiota!
I've got some new material that you can practise with.

G1 Fill in the relative pronouns who, whose, that or which.

1 Who is the first person _____ comes to your mind when you think about physics?

2 Is it one of those people _____ lived in ancient Greece?

3 Aristotle was the name _____ came to my mind first.

4 Aristotle, _____ name means "the best purpose", was born in 384 BC.

5 He developed western philosophy, _____ is quite something.

6 Do you know the name of the person _____ invented the computer?

7 The word "computer" was first used to describe a human _____ performed calculations.

8 The Difference Engine, _____ was considered to be the first automatic computing machine, was developed by Charles Babbage.

9 All _____ he did day and night was develop the Difference Engine.

10 Alan Turing, _____ Enigma machine played a key role in cracking coded messages _____ enabled the Allies to defeat the Nazis, died in 1954.

The Difference Engine No. 2, one of the world's earliest computer designs.

G2 Complete the following sentences. Pay special attention to the relative pronouns and prepositions.

1 The person _____ (jonka kanssa Marie oli naimisissa) was called Pierre.

2 It was the programme _____ (jota odotin).

3 It was something _____ (mistä en tiennyt mitään).

4 This is the person _____ (jolle puhuin) yesterday.

5 He has invented a dog house, _____ (jonka katto voidaan aukaista).

6 Who was the first person _____ (jonka tapasit tänä aamuna)?

7 The club _____ (johon kuulun) is called SAS – Serious About Science.

8 Everything _____ (mitä hän sanoi, teki minut onnelliseksi).

9 The party _____ (jota äänestin, voitti vaalit).

10 Mr Bean, _____ (jolle puhuin kokouksessa), is very interested in my proposal.

The ancestor of your phone.

WHAT se, mikä; se, mitä

- **What** sisältää korrelaatin, joten se ei viittaa edeltävään sanaan tai lauseeseen.

  What he said was true.
  Se, mitä hän sanoi oli totta.

Vertaa:

What he deserves is a thank you. → All **that** he deserves is a thank you.
Se, mitä... Kaikki, mitä..., korrelaattina *all*

Huomaa:

What I saw was a beautiful drawing. → ~~That~~ what I saw...
Se, mitä näin...

G3 Who, which, that or what? Choose the correct option.

1 The Richter scale is an open-ended scale **which** / **what** indicates the severity of earthquakes.
2 Software is a set of instructions **that** / **who** runs a computer's hardware.
3 A neuron is a nerve cell of **that** / **which** the human nervous system has some 10 billion.
4 An ion is an atom or a molecule **that** / **what** is electrically charged.
5 Gravity is a force **what** / **which** moves objects towards each other.
6 Einstein was the scientist **who** / **which** explained how gravity works.
7 *The Origin of Species* was a book **which** / **who** shocked religious people.
8 Charles Darwin, the man **what** / **that** wrote the book, denied being an atheist.
9 **What** / **That** he said made a lot of sense.
10 Is everything **that** / **what** Darwin wrote still valid today?

Ei relatiivipronominia

- Relatiivipronominin **voi jättää pois, jos** se on lauseen **objekti** eli tekemisen kohde:

  objekti
  The man (who / that / whom) we met last night was a chemist.

- Relatiivipronominia **ei voi jättää pois, jos** se on lauseen **subjekti** eli tekijä:

  subjekti
  The man **who** stole my money is now in prison.

Pilkun käyttö relatiivilauseessa

- **Käytä pilkkua, jos lause on irrallinen**, lisähuomautuksen kaltainen relatiivilause:
  The girl, whose suitcases were heavy, was trying to get a taxi.

- **Ei pilkkua, jos lause on kiinteä**, ymmärtämisen kannalta välttämätön
  The only French word that I could understand was *merci*.

G4 **Fill in the missing relative pronouns. Put the pronoun in brackets if it can be left out.**

1 The woman _____ lives next door is a doctor.
2 My sister, _____ lives in Australia, is a molecular scientist.
3 We stayed at the hotel _____ you recommended.
4 We stayed at the Ritz, _____ a friend of mine recommended.
5 The woman _____ I wanted to see is a chemist.
6 Have you found the formula _____ you lost?
7 Is there anything _____ I can do?
8 _____ they said, could not be translated.
9 The man, _____ I was sitting next to on the plane, was an algae expert.
10 Where is the helmet _____ I bought yesterday?

Erityistapauksia

- Rakenteessa *joista monet / jotkut / jotkin* käytetään **whom**-muotoa ihmisistä, **which** asioista.

  There were a lot of people at the party, **most of whom** were vegetarians.
  Juhlissa oli paljon ihmisiä, joista suurin osa oli kasvissyöjiä.

  They had three driverless cars, **one of which** was yellow.
  Heillä oli kolme robottiautoa, joista yksi oli keltainen.

many	joista moni
one	joista yksi
some	joista jotkut
none	joista ei kukaan
most	joista suurin osa
few	joista harvat
a few	joista muutamat
both	joista molemmat

of whom (ihmisistä) / of which (asioista)

- **Ne, jotka**

  Those who want to participate in this event, sign up here!

- **Yleistävä ever-pääte**: whatever, whenever, wherever, however (mitä tahansa, milloin tahansa, missä tahansa, miten tahansa)

  Wherever you go, take your phone with you.

- **Where** on usein kätevämpi kuin *prepositio + which*

  This is the house **where** / **in which** I want to live.

G5 Fill in the correct relative pronouns. Then listen and check your answers.

1 I have a lot of friends, _____ (joista moni) are interested in physics.
2 The scientists, _____ (joista suurin osa) were women, were all interested in one thing: the truth.
3 The chemicals, _____ (joista jotkut) can be very dangerous, were stolen.
4 She gave two statements, _____ (joista yksi) was true.
5 Many chemicals were on display, _____ (joista muutama) had never been seen before.
6 Jo was surprised to see so many people in the lab, _____ (joista ei kukaan) were scientists.
7 "_____ (Mitä tahansa / mitä ikinä) they were doing there, they were not there to look at the chemicals," Jo told the police afterwards.
8 The police officers, _____ (joista ei kukaan) knew anything about chemistry, were getting worried.

G6 Match the sentences. Translate them in pairs.

1 Curiosity is a car-sized rover _____
2 What was the name of the spacecraft _____
3 Neil Armstrong was the man _____
4 Carbon dioxide is something _____
5 Pluto, _____
6 Mars is home to the tallest mountain _____
7 The only people _____

A that can be found in the atmosphere.
B that took the first men to the Moon?
C that can be found in our solar system.
D that explores Mars.
E who said, "The Eagle has landed."
F who have walked on the Moon, have been American males.
G which is no longer classified as a planet, is made of ice and rock.

G7 Fill in the missing relative pronouns. Put the pronoun in brackets if it can be left out. Sometimes more than one option is possible.

Dear Editor

I am one of those people **1** _____ are against killing animals. My mother, **2** _____ father wrote vegetarian cookbooks, once said to me: "There is very little **3** _____ you can do about people **4** _____ love meat. After all, those **5** _____ eat meat have been around, historically speaking, much longer than those **6** _____ refuse to eat it. There are many people for **7** _____ a juicy steak is the ultimate food."

I recently read an article about artificial meat, **8** _____ is something **9** _____ I knew very little about. The investigative journalist **10** _____ wrote the article was very thorough, and **11** _____ he said really made me think.

The whole idea of artificial meat poses a moral dilemma to those of us **12** _____ are vegetarian. It is true that animals don't actually get killed to provide the artificial meat. Does this mean vegetarians can eat it? I think not. There is something **13** _____ is deeply wrong about growing meat in the laboratory. All the vegetarians to **14** _____ I spoke about this felt the same. The best response **15** _____ I got was: "Growing meat? Won't it be cheaper to just grow corn?"

Yours

Pat Barker

Manchester

G8 In pairs, decide which one of you is A and B. Cover the other half. Take turns translating the sentences into English.

	A	B
1	**The woman who lives next door is a scientist.**	Nainen, joka asuu naapurissa, on tutkija.
2	Hän työskentelee yrityksessä, joka valmistaa avaruuspukuja.	**She works for a company that makes spacesuits.**
3	**She once told me about making spacesuits, which I found interesting.**	Hän kertoi kerran avaruuspukujen valmistamisesta, mikä oli minusta mielenkiintoista.
4	Se, mikä todella teki minuun vaikutuksen, oli hänen suuri vastuunsa.	**What really impressed me was the great responsibility she had.**
5	**She works with a large group of scientists, all of whom are experts.**	Hän työskentelee suuressa ryhmässä tutkijoita, joista kaikki ovat asiantuntijoita.
6	Hän ei tunne kaikkia ihmisiä, joiden kanssa työskentelee.	**She doesn't know all the people who/that she is working with.**
7	**Those who are in/on her team are testing ideas for spacesuits that could be worn on the moon.**	Ne, jotka ovat hänen tiimissään, testaavat ideoita puvuiksi, joita voisi käyttää kuussa.
8	Hän sanoi, että ensimmäinen idea, joka tulee mieleen, ei ole aina paras.	**She said that the first idea that comes to mind is not always the best.**
9	**The suit has to protect the astronaut from temperatures which/that can be as hot as 250 degrees.**	Puvun täytyy suojata astronautteja lämpötiloilta, jotka voivat olla jopa +250 astetta.
10	Se, mitä en tiennyt, oli avaruuspuvun virallinen nimi: Extravehicular Mobility Unit.	**What I didn't know was the official name of the spacesuit: Extravehicular Mobility Unit.**

Lauseenvastikkeet · Shortened clauses

In pairs, take turns to read the sentences.

1 I have just finished a book called *The World's Weirdest Places*.
2 It introduces paranormal phenomena appearing in different parts of the world.
3 While lying in bed and dreaming about these fascinating places, I immediately wanted to book a flight to see some of them.
4 Having read the book, I was still not convinced that mysterious things such as lake monsters or portals to other dimensions really existed.
5 Though being an entertaining collection of tales, the book has some factual content.
6 Not containing enough hard scientific evidence, the book failed to make me believe in supernatural places.
7 Generally speaking, I enjoy learning something new about the unsolved mysteries of the world.
8 But I think I would rather sit at my desk reading scientific articles instead of wild stories about UFOs and aliens.

G9 **Find the following expressions in the sentences and underline them.**

jonka nimi on	joita esiintyy	maatessani	luettuani
vaikka kirja on	koska kirja ei sisältänyt	yleisesti ottaen	lukemassa

Lauseenvastikkeet

Alleviivatuissa rakenteissa on käytetty lauseenvastikkeita.

Niitä käytetään etenkin kirjoitetussa kielessä tiivistämään tekstiä ja tuomaan lauserakenteisiin vaihtelua.

Lauseenvastikkeiden ymmärtäminen teksteissä on tärkeää vaikka niitä ei itse käyttäisikään.

- Lauseenvastikkeissa **tiivistetään** osa virkettä, yleensä sivulause.

  Science fiction novels are often about **aliens which live** on other planets.
  Science fiction novels are often about **aliens living** on other planets.
  Science fiction -romaanit käsittelevät usein avaruusolioita, jotka asuvat muilla planeetoilla.

  After I had read the book on scientific mysteries, I felt disappointed.
  After reading / Having read the book on scientific mysteries, I felt disappointed.
  Kun olin lukenut / Luettuani kirjan tieteellisistä arvoituksista tunsin itseni pettyneeksi.

- Kielteisessä lauseenvastikkeessa **not** tulee ennen verbiä.

  Because I **did not know** much about this topic, I couldn't understand the book.
  Not knowing much about this topic, I couldn't understand the book.
  Koska en tiennyt aiheesta paljoakaan, en ymmärtänyt kirjaa.

G10 Translate the shortened clauses into Finnish.

1 Dr Sato was a robot specialist doing research on artificial intelligence.
2 Not having any other interests, Dr Sato spent a lot of time at work.
3 After studying robots for many years, the professor finally wanted one for himself.
4 Having bought a companion robot, he lost all interest in people.
5 Being a very precise and organised man, Dr Sato said that he could not imagine living with an untidy human being.
6 If given the opportunity, Dr Sato will design a whole new line of companion robots.

Lauseenvastikkeita muodostettaessa täytyy olla tarkkana, että pää- ja sivulauseessa on sama tekijä.

Vertaa seuraavia esimerkkejä:

- **Sama tekijä** pää- ja sivulauseessa:

  After scientists had studied several crop circles, **they** were sure teenagers had made them.

  Lauseenvastike:

  After studying several crop circles, **scientists** were sure teenagers had made them.
  Tutkittuaan useita peltokuvioita tutkijat olivat varmoja, että nuoret olivat tehneet ne.

- **Eri tekijä** pää- ja sivulauseessa:

  While a group of scientists were inspecting a crop circle, **a herd of cows** rushed into the wheat field.

  Virheellinen lauseenvastike:

  While inspecting a crop circle, **a herd of cows** rushed into the wheat field.
  Tutkiessaan peltokuviota lehmälauma ryntäsi viljapellolle.

  Lauseilla on oltava sama tekijä, jotta lauseenvastikkeesta tulee järkevä.

Lauseenvastikkeita muodostetaan yleensä sivulauseista

1) Relatiivilauseet (who, which, that)

- **Aktiivissa**: relatiivipronomini pois ja verbistä ing-muoto

  Dr Jones is a scientist **who specialises in** paranormal phenomena. →
  Dr Jones is a scientist **specialising in** paranormal phenomena.

- **Passiivissa**: relatiivipronomini ja be-verbi pois, jäljelle jää verbin 3.muoto

  He would like to see the rock **which was found** in the desert. →
  He would like to see the rock **found** in the desert.

Verbimuotona käytetään **infinitiiviä eli perusmuotoa**, jos se sana, johon viitataan (korrelaatti) on superlatiivi, järjestysluku, tai joku sanoista *the first, the last, the next, the only*.

The only thing that will make Dr Jones quit his research is a lack of money. →
The only thing to make Dr Jones quit his research is a lack of money.

G11 **Use a shortened clause instead of a relative clause.**
The first one has been done for you.

1 Do you believe in the Yeti **which has been seen** by some mountaineers in the Himalayas?
Do you believe in the Yeti **seen** by some mountaineers in the Himalayas?

2 The alien who was injured in the accident is now in hospital.
3 The food which was offered to the alien in hospital made her feel sick.
4 The robots that were now attacking the humans were actually made by humans.
5 The building which was destroyed by ball lightning was located on Kings Road.
6 The people who had been walking on the street were unharmed.
7 Zebras that live in areas with lots of flies tend to have stripes.
8 Scientists who studied ball lightning were awarded a science prize.

2) Aikaa ilmaisevat sivulauseet (when, while, before, after, since)

- Aikaa ilmaisevat sivulauseet voidaan lyhentää **ing-muodolla**. Niissä on yleensä konjunktio **when, while, before, after, since**.
- Niissä voidaan käyttää myös pidempää muotoa **having + verbin ed-muoto / 3. muoto**. Pidemmän muodon kanssa ei käytetä konjunktiota.

After I had read an article on the Bermuda Triangle, I wanted to learn more about the mysterious accidents in the area. →

Sen jälkeen kun olin lukenut artikkelin Bermudan kolmiosta, halusin tietää lisää salaperäisistä onnettomuuksista alueella.

After reading an article on the Bermuda Triangle, I wanted to learn more about the mysterious accidents in the area.

Having read an article on the Bermuda Triangle, I wanted to learn more about the mysterious accidents in the area.

Luettuani artikkelin Bermudan kolmiosta halusin tietää lisää salaperäisistä onnettomuuksista alueella.

Since he came back from the expedition to the Amazon, Dr Clark has been feeling unwell. →

Siitä lähtien kun hän palasi tutkimusmatkalta Amazonille, tri Clarke on tuntenut olonsa huonovointiseksi.

Since coming back from the expedition to the Amazon, Dr Clark has been feeling unwell.

Palattuaan tutkimusmatkalta....

Huomaa merkitysero:

While reading the book, I kept thinking about dinner.
Lukiessani...

After reading the book, I ordered a pizza.
Luettuani...

Insect stew, anyone?

G12 Rewrite the sentences using shortened clauses. The first one has been done for you.

1 **After zoologists had studied** different species of flies, they were able to solve the mystery of the zebra's stripes. →
After studying / Having studied different species of flies, **zoologists** were able to solve the mystery of the zebra's stripes.

2 After he had heard so much about the poo bus, Lu wanted to see it for himself.
3 Since she visited the cattle farm in July last year, Tea has not eaten beef.
4 While she was surfing the net, Tea found a site giving information about alternative foods.
5 Before Tea ordered products like dried bugs, she wanted to know what they would taste like.
6 After he had passed the hygiene test, Larry was ready to start working at the Eco Café.

poo bus biobussi

3) Syytä ilmaisevat sivulauseet (as, because, since)

Syytä ilmaisevat lauseenvastikkeet voidaan muodostaa

- käyttäen **ing-muotoa**.

  Because she was a scientist, Dr Lewis refused to believe in little green men. →
  Being a scientist, Dr Lewis refused to believe in little green men.
  Koska tri Lewis oli tutkija, hän kieltäytyi uskomasta pieniin vihreisiin miehiin.

  As the university had an excellent reputation, it refused to fund the study concerning giant chickens. →
  Having an excellent reputation, the university refused to fund the study concerning giant chickens.
  Koska yliopistolla oli erinomainen maine, se kieltäytyi rahoittamasta jättikanoihin liittyvää tutkimusta.

- käyttäen pidempää muotoa **having + verbin ed-muoto / 3. muoto.**

  Because the company had funded Dr House's research, they expected to get results quickly. →
  Having funded Dr House's research, the company expected to get results quickly.
  Koska yhtiö oli rahoittanut tri Housen tutkimusta, se odotti saavansa nopeasti tuloksia.

- käyttäen **verbin ed-muotoa / 3. muotoa**.

  Since she was pressed for time, Dr Lewis was unable to complete the report. →
  Pressed for time, Dr Lewis was unable to complete the report.
  Koska tri Lewisillä oli kiire, hän ei pystynyt viimeistelemään raporttia.

- Niissä ei käytetä konjunktiota *as*, *because*, *since*.

G13 Rewrite the sentences by shortening each part in bold.

1 **Since he was** a wealthy man, Ben funded the world's first commercial spaceline.
2 **As Jo was not able** to buy a ticket to Mars, she bought one to the moon instead.
3 **Because Richard had read** a lot about climate change, he decided to join the green party.
4 **As Richard did not want to own** anything, he sold all his possessions and went to live in the Nevada desert.
5 **Because Dr Croft had been working** so hard for many years, she needed a holiday.
6 **Since Dr Croft was given** time off from work, she planned a three-week holiday in Kenya.

Lauseenvastike rinnastetuista päälauseista

- Kahdesta *and*-sanalla yhdistetystä päälauseesta toinen voidaan korvata lauseenvastikkeella.

  Dr Lorenz **closed the lab door and smiled** broadly as he thought of the moving rocks in Death Valley. →

  Dr Lorenz **closed the lab door, smiling** broadly as he thought of the moving rocks in Death Valley

  Tri Lorenz sulki laboratorion oven hymyillen leveästi kun hän ajatteli Death Valleyn liikkuvia kiviä.

Lauseenvastikkeet vakiintuneissa sanonnoissa

compared with/to	verrattuna jhk
considering	ottaen huomioon
generally speaking	yleisesti ottaen
given that	ottaen huomioon
including	mukaan lukien
judging by	päätellen jstk
providing/provided that	edellyttäen että
supposing that	olettaen että
weather permitting	sään salliessa

Weather permitting, we will do the experiment outside.

Sään salliessa teemme kokeen ulkona.

G14 In pairs, decide which one of you is A and B. Cover the other half. Take turns saying the sentences by shortening the expressions in bold. Your partner will check your answers.

	A	B
1	**When I had read** the article, I gave it to my boyfriend.	After reading / Having read the article, I gave it to my boyfriend.
2	People eating meat regularly don't want to read about eating insects!	People **who eat** meat regularly don't want to read about eating insects!
3	Yes, **as I am** a vegetarian myself, it's hard for me to understand his attitude.	Yes, being a vegetarian myself, it's hard for me to understand his attitude.
4	Not knowing anything about your boyfriend, I can't really comment.	**Because I don't know** anything about your boyfriend, I can't really comment.
5	**After he made** his decision to continue eating meat, he's not going to try alternative foods.	Having made / After making his decision to continue eating meat, he's not going to try alternative foods.
6	When researching future foods, I read that insects are a good source of protein.	**When I was researching** future foods, I read that insects are a good source of protein.
7	**If ground insect powder is gradually included** in his food, it is an excellent way to make him eat future foods without realising it!	If gradually included in his food, ground insect powder is an excellent way to make him eat future foods without realising it!
8	That is the last thing to make him change his mind.	That is **the last thing that will make** him change his mind.

G15 Rewrite the sentences by shortening each part in bold.

1 **If we consider** all the tasks the new generation of robots can perform, one can only marvel at their expertise.
2 I was told about **a man who attacked** a robot in a fit of rage in Tokyo, but maybe it wasn't Pepper.
3 However, **as we have made** these robots, we humans should treat them properly.
4 Personally, **because I am** a social type of person, I'd rather deal with people than with robots.
5 **After the police checked** the security cameras at the robotics research lab, they arrested the intruders.
6 **The scientist who was conducting** an experiment accidentally blew up the lab.
7 The fire brigade entered the facility **and checked** the other labs for possible fires.
8 **While the firefighters were putting out** the fire, they found the scientist unconscious but otherwise unharmed.

G16 What is wrong with the following sentences? Rewrite them so that they are more logical. The first one has been done for you.

1 While tidying up her room, the cat brought in a mouse. →
While Sheila was tidying up her room, the cat brought in a mouse.

2 Driving on the motorway, a rock blocked our way.
3 Walking past the laboratory, the skeleton frightened me.
4 I saw an accident getting on the bus.
5 Driving like a maniac, the moose was hit and killed.
6 She handed out sugary cookies to the children kept in tall jars.
7 Freshly painted, Alison left the deck to dry.
8 Newton smelled apples coming down the stairs for dinner.
9 Covered in mustard and ketchup, I bit into the hot dog.
10 Being in bad shape, I was able to buy the apartment very cheaply.

Singular and plural: irregular forms

Translate the sentences into Finnish.
Pay attention to the words in bold.

1 **Inventors** don't always make **money** from their **inventions**.
2 I haven't heard how Jim's exchange year is going, but maybe no **news is** good news.
3 The **equipment is** in the cupboard. Be careful with **it**!
4 The **cabin staff** on the aircraft **is** trained to handle emergency situations.
5 The **staff are** enjoying themselves while the boss is away.
6 **The Members of Parliament have** differing **points of view** on the issue.

Englannissa monikko, suomessa yksikkö

Suomenna seuraavat sanat, jotka ovat englannissa monikkoja, mutta suomessa yksikköjä. Niiden kanssa **verbi on englannissa monikkomuodossa**.

contents _____ customs _____

premises _____ scales _____

the minutes _____ manners _____

cattle _____ police _____

surroundings _____

The scientist thinks his **scales** **are** broken. No mouse can weigh five kilos.
Tutkija epäilee, että vaaka on rikki.

The **surroundings** **are** quiet.
Ympäristö on hiljainen.

The **contents** **are** listed at the beginning of the book.
Sisältö on listattu kirjan alkuun.

Huomaa:

a police officer yksittäinen poliisi
The police **were** investigating the incident.
A police officer **was** sent to arrest the suspect.

The Middle Ages keskiaika
The Middle Ages **was**/**were** also described as the Dark Ages.

G17 Choose the correct form. Translate the sentences into Finnish.

1 Larger premises usually **cost** / **costs** a company more money.
2 The surroundings of the research centre **is** / **are** beautifully landscaped.
3 The contents of Charles Darwin's personal library **is** / **are** now available online.
4 The minutes of the previous meeting **was** / **were** read and approved.
5 New research suggests that good manners **is** / **are** important in keeping us healthy.
6 The police **have** / **has** been informed about the incident.
7 **This** / **These** scales **are** / **is** so accurate that a speck of dust can affect the measurement.
8 So far this year, customs **has** / **have** seized 300 tons of fireworks.

landscape maisemoida, maisema, maisemakuva

Englannissa yksikkö, suomessa monikko

Suomenna seuraavat sanat, jotka ovat englannissa yksikköjä, mutta suomessa monikkoja. Niiden kanssa **verbi on englannissa yksikkömuodossa**.
Myös tarvittavat pronominit ovat yksikössä. Näiden sanojen kanssa ei käytetä artikkeleita *a/an*.

advice _____ housework _____

baggage, luggage _____ information _____

equipment _____ jewellery _____

evidence _____ knowledge _____

furniture _____ money _____

homework _____ news _____

The doctor's **advice was** very useful.
Neuvot olivat...

Art deco **furniture was** first designed in Paris in the 1920s.
Huonekalut suunniteltiin ensimmäisenä...

Mikäli halutaan erityisesti korostaa esimerkiksi yksittäistä tietoa, korua, matkatavaraa tms., käytetään rakennetta **a piece of** tai **an item of**.

This piece of news is quite shocking.

Huomaa:
Seuraavat sanat ovat englannissa tavallisia, laskettavissa olevia ja epämääräisen artikkelin (*a, an*) kanssa käytettäviä sanoja. Suomessa ne ovat monikkomuotoja.

a brain _____ a face _____

a hair, hair _____ a party _____

a wedding _____ a funeral _____

The party was cancelled.
Juhlat peruttiin.

G18 Choose the correct form. Translate the sentences into Finnish.

1 **This** / **These** homework **is** / **are** really easy.
2 It looks like my baggage **has** / **have** got lost. I'll have to report it to the Baggage Service Office.
3 Thank you so much for your advice! **It** / **They was** / **were** really useful.
4 My cousin's wedding **was** / **were** very enjoyable.
5 What have you done to your face? **It** / **They look** / **looks** different.
6 I have to go the hairdresser's. My hair **needs** / **need** cutting.
7 I don't think **these** / **this** information **help** / **helps** us much. We need to know more about the topic.
8 I really need a break from revision. My brain i**s** / **are** overloaded.

Kollektiivisubstantiivit

Joidenkin ihmisryhmiin viittaavien sanojen kanssa voidaan käyttää **joko yksikkö- tai monikkomuotoista verbiä** riippuen siitä, ajatellaanko sanan kuvaavan **ryhmää** (yksikkö) **vai koostuvan yksilöistä** (monikko). Tätä sanaryhmää kutsutaan kollektiivisubstantiiveiksi. Verbi on monikossa usein silloin, kun viitataan ryhmän jäsenten tunteisiin ja ajatuksiin.

army	jury
band	management
committee	orchestra
crowd	population
family	staff
government	team

The band was at the top of the charts.
The band were arguing over which song should start the gig.

A team is only as good as **its** leader.

Yhdyssanat ja sanaliitot

- Jos yhdyssana koostuu kahdesta substantiivista, s-pääte tulee aina sanan loppuun.
  dishwasher → dishwasher**s**
- Jos yhdyssana muodostuu substantiivista ja prepositiosta tai adverbistä, -s-pääte tulee yleensä ensimmäiseen substantiiviin. Kirjoita listan sanat monikossa ja suomenna ne.

parent-in-law _____ _____

point of view _____ _____

passer-by _____ _____

Member of Parliament _____ _____

editor-in-chief _____ _____

Sally's **parents-in-law** want to live in the countryside.
We don't often have differing **points of view**.

Huomaa:

grown-up → grown-up**s**

G19 Fill in the correct form of the word.

1 The orchestra _____ over eighty players. (koostuu)

2 Selena's family _____ originally from Mexico. (on)

3 The army _____ defeat the invaders. (kykeni, pystyi)

4 _____ stayed to watch the performance. (ohikulkijat)

5 _____ were invited to give a presentation at the conference in June. (päätoimittajat)

6 Asking my teenage sons to act like _____ is a waste of time. (aikuiset)

7 Her _____ are coming all the way from Australia to attend the wedding. (appivanhemmat)

G20 Choose the correct word.

1 The committee **has** / **have** decided to give Professor Marshal a grant to continue his research on autism.
2 She went to the baggage reclaim, but her luggage **was** / **were** not there.
3 Jeff thinks Manchester United **are** / **is** the greatest football team the world has ever seen.
4 The police **are** / **is** investigating the explosion at the lab.
5 The research was published 50 years ago, but the information **is** / **are** still valid.
6 Her knowledge of quantum computing **are** / **is** impressive.
7 The crowd **was** / **were** protesting against GM foods.
8 The company's new premises **are** / **is** really high-tech.

G21 Translate into English.

1 Kokouksen pöytäkirja on netissä.
2 Syntymäpäiväjuhlat olivat upeat.
3 Nämä tiedot eivät voi olla totta.
4 Antamasi tieto oli oikein hyödyllinen.
5 Milloin valamiehistö on tulossa paikalle?
6 Missä rahat ovat?
7 Kaksi kansanedustajaa pidätettiin.
8 Laatikon sisältö oli yllättävä.

Numeraalit · Numerals

G22 Listen to the following story and pay attention to the numerals. Fill in the gaps while listening. Translate the expressions into Finnish.

The man who invented the 21st century

1	the _____ century	_____
2	_____ 1856	_____
3	_____ the age of 28	_____
4	_____ _____ past _____	_____
5	_____ of	_____
6	_____ 1880s	_____
7	_____ as much	_____
8	_____ _____ early 1890s	_____
9	hundreds of _____ of	_____
10	_____ fifth	_____

Perusluvut (cardinal numbers)		Järjestysluvut (ordinal numbers)	
1	one	1st	first
2	two	2nd	second
3	three	3rd	third
4	four	4th	fourth
5	five	5th	fifth
• • •			
8	eight	8th	eighth
9	nine	9th	ninth
• • •			
12	twelve	12th	twelfth
13	thirteen	13th	thirteenth
• • •			
20	twenty	20th	twentieth
21	twenty-one	21st	twenty-first
• • •			
30	thirty	30th	thirtieth
32	thirty-two	32nd	thirty-second
• • •			
40	forty	40th	fortieth
• • •			
100	one hundred	100th	hundredth
103	a/one hundred and three	103	hundred and third

Huomaa:

a million miljoona

a billion miljardi

a trillion biljoona

- Kirjoita pienet luvut kirjaimin.

  nine or **ten** experiments, **20** inventions

- Laita kirjoittaessa kymmenten ja ykkösten väliin väliviiva.

  fifty-five

- Erota suuri luku pilkulla tai välilyönnillä kolmen numeron välein lopusta lukien.

  1,500 / 1 500
  lue: one thousand five hundred / fifteen hundred

- Jos kyseessä on vuosiluku, pilkkua tai välilyöntiä ei käytetä.

  1985
  lue: nineteen (hundred and) eighty-five

  2027
  lue: twenty twenty-seven

- Yhtä tusinaa / sataa / miljoonaa edeltää **a** tai painokkaampi **one**.

  a dozen phenomena, £100 = **one** hundred pounds

- Lukusana on yksikkömuodossa lukusanan ja **a few**, **several** ja **a couple of** jälkeen.

  a few **million** euros

  several **billion** pounds (miljardi)

  a couple of **hundred** dollars

- Epämääräisessä ilmaisussa käytä rakennetta **dozens of** (kymmeniä), **thousands of** (tuhansia), **tens of thousands of** (kymmeniä tuhansia).

  dozens of people

  thousands of alumni

  tens of thousands of diagnoses

Järjestysluvut

- Järjestyslukujen pääte on **-th**. Laita tunnus viimeisen lukusanan perään. Järjestyslukua edeltää määräinen artikkeli tai omistussana.

  This is **the** eigh**th** case today.
  It's **our** school's hundred and twentie**th** anniversary!

- Poikkeuksia ensimmäinen, toinen ja kolmas.

  The **first** prize / 1**st**
  The **second** step / 2**nd**
  The **third** runner / 3**rd**

Murtoluvut

- Murtolukujen nimittäjänä on yleensä järjestysluku

  ⅓ one third, a third

- poikkeuksen muodostavat **half** ja **quarter**

  ½ one half, a half
  ¼ one quarter, a quarter

- Kun osoittaja on suurempi kuin yksi, käytä nimittäjässä monikkoa.

  ⅔ two third**s**

- Käytä desimaaliluvussa pistettä (point)

  3.14159 π [pai]

- Numerot luetaan yksittäin ja nollaa kokonaislukuna ei yleensä lueta eikä kirjoiteta.

  0.5 **lue**: point five (nought point five / zero point five / oh point five)

- Huomaa, että prosenttilukua seuraava verbi on monikossa.

  74 % of the samples include blue-green algae. (**lue**: per cent, percent)

G23 Fill in the gaps. Write all numbers in letters.

High school science fairs

Every year **1** _____ (tuhannet) American high schools organise science fairs. This allows **2** _____ (kymmenien) eager students to present their science projects to a wider audience. The range of projects is very varied. One music fan analysed **3** _____ _____ (2856) pop songs in search of earworms, while another student investigated vitamin retention in cooked broccoli – apparently boiling causes **4** _____ (64 prosenttia) of vitamin C to be lost. Sometimes companies sponsor these science fairs offering prizes of up to **5** _____ (10 000) dollars. As the amounts of money grow, so too does the ambition of the projects.

Earlier, most experiments were done in family kitchens, but now almost **6** _____ (⅔) are carried out in professional science laboratories. Jackie Crowther, a parent and a former prizewinner at Pine Bridge High science fair, now celebrating its **7** _____ (50.) anniversary, remembers the good old days: "The **8** _____ (ensimmäinen) prize was a cup," she said. "The **9** _____ (toinen) prize was a couple of movie tickets, and the third **10** _____ (muutamia kymmeniä) oranges."

retention säilyttäminen, säilytys

Nolla

- Puhelinnumero ja muut luettelot: **oh** /ou/ tai **zero**.
  His room number is 505. /faiv ou 'faiv/
- Lämpöasteikko ja muut asteikot: **zero**.
  It's -10 °C. (10 below zero / minus 10)
- Numero nolla: **nought** (BrE), **zero** (AmE)
  There are six noughts in a million.
- Jalkapallo: **nil**.
  Chelsea beat Manchester 3–0. (three-nil)
- Jääkiekko: **nothing**.
  Chicago beat Pittsburgh 4–0. (four-nothing)
- Tennis, squash ja sulkapallo: **love**.
  Novak Djokovic is leading 15–0. (fifteen-love)

Matematiikkaa

8 + 7 = 15	eight plus /plas/ seven is / equals fifteen
10 – 6 = 4	ten minus /mainəs/ six is four
3 x 3 = 9	three times three is nine
10 : 2 = 5	ten divided by two is five
$2^2 = 4$	two squared is four
$2^3 = 8$	two cubed is eight
$2^4 = 16$	two to the fourth / to the power of four is 16
$\sqrt{9} = 3$	The square root of nine is three

G24 In pairs, decide which one of you is A and B. Cover the other half. Take turns saying the numbers in English.

	A	B
1	+358-22-1753480	**plus three five eight ... double two ... one seven ... five three ... four eight zero/oh**
2	**plus double four ... six double nine ... zero/oh five ... four double three ... two one**	+44-699-0543321
3	Ulkona on -15 astetta.	**It's minus fifteen degrees / 15 below zero (outside).**
4	**It's often 25 degrees in summer.**	Kesällä on usein 25 astetta.
5	Peter voitti minut sulkapallossa 5–0.	**Peter beat me five-love at badminton.**
6	**I was leading three love when the tennisball hit my nose.**	Johdin 3–0 kun tennispallo osui nenääni.
7	30 - 3 = 27	**Thirty minus three is/equals twenty-seven.**
8	**One hundred and one plus forty is/equals one hundred (and) forty-one.**	101 + 40 = 141
9	7 x 8 = 56	**Seven times eight is fifty-six.**
10	**Ninety divided by ten is nine.**	90 : 10 = 9

Ikä

Your life begins **at the age of 18** / **at 18**.	jonkun ikäisenä
Her boyfriend is 20 years old.	...20 vuotta vanha.
She is a 20-year-old millionaire.	...20-vuotias miljonääri.
twenty-something	21–29 vuotta
twentyish	parikymppinen
in his early thirties	yli 30-vuotias
in his mid-fourties	noin 45-vuotias
in his late fifties	lähes 60-vuotias

Lukusanat ajan ilmaisuissa

Kellonajat

What time is it?	It's...
8.50	ten to nine / ten of nine (AmE)
9.10	ten past nine / ten after nine (AmE)
10.15	(a) quarter past ten / ten fifteen
6.30	six thirty / half past six / half six (BrE)
7	seven o'clock / seven
6.24	twenty-four minutes past six / six twenty-four
5 am/pm	am = aamulla / pm = illalla

Päivämäärät

Armstrong walked on the moon on July 20, 1969.
lue: July (the) twentieth, nineteen sixty-nine

Huomaa ero:

10 May 2021 or 10.5.2021 (BrE)	the tenth of May, twenty twenty-one
May 10, 2021 or 5 /10 /2021 (AmE)	May (the) tenth, twenty twenty-one

Vuorokaudet, viikot, kuukaudet

24 hours vuorokausi

The DNA samples taken from the crime scene were processed in less than 24 hours.

48 hours kaksi vuorokautta

Studies show that within 48 hours of quitting smoking your sense of smell and taste will begin to improve.

a fortnight (BrE), two weeks (AmE) kaksi viikkoa

The equipment should be checked once a/every fortnight. (BrE)
The equipment should be checked once every two weeks. (AmE)

mm. lasten iät:

six months puolivuotias
eighteen months puolitoistavuotias

According to NASA, a mission to Mars will take two and a half years – six months to reach Mars, eighteen months on the planet, and six months to return to Earth.

Vuodet

- Vuosilukujen kanssa käytä prepositiota **in**

  in 2040 (in the year 2040)

  The UN estimates that **in** (the year) 2040, the world population will reach 9,038,687,000.

- Vuosilukujen yhteydessä näet käytettävän näitäkin ilmauksia:

BCE	Before Common Era	eaa	ennen ajanlaskun alkua
BC	Before Christ	eKr	ennen Kristusta
CE	Common Era	jaa	jälkeen ajanlaskun alun
AD	Anno Domini	jKr	jälkeen Kristuksen

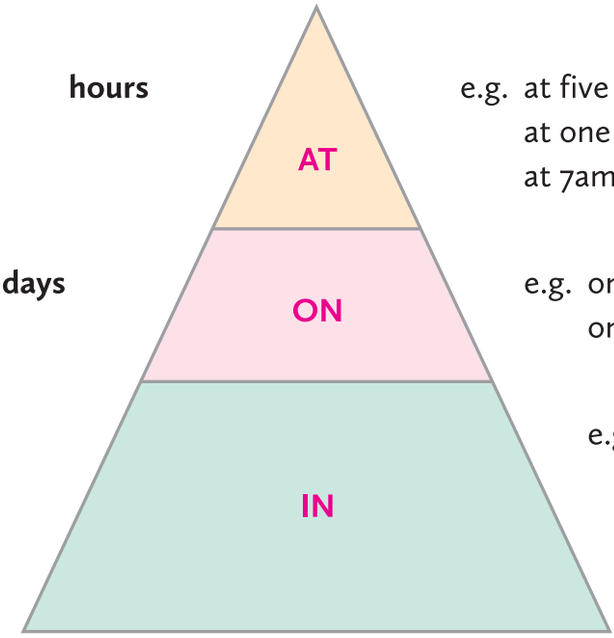
It took place in 500 BCE.

Scholars think that the Chinese alchemists invented gunpowder in 850 CE.

STUDY TIP

Time prepositions

To remember time prepositions think of a pyramid. At the bottom there are longer time periods, and at the top there are precise times.



hours

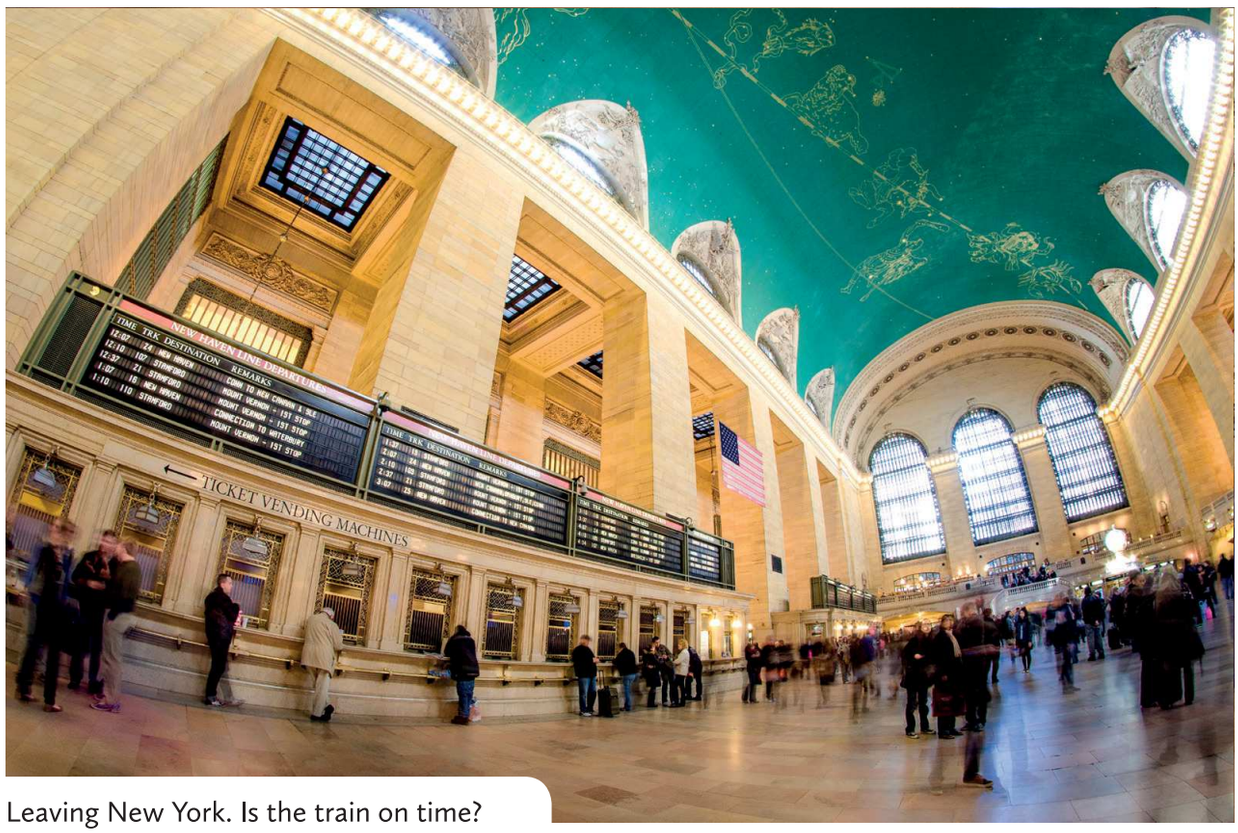
e.g. at five past eleven,
at one thirty,
at 7am

days

e.g. on Friday,
on the 15th of February

months
years
decades
centuries

e.g. in May, in summer,
in 2016,
in the 1990s,
in the 21st century



Leaving New York. Is the train on time?

G25 Translate into English.

1 Kello on nyt puoli kolme, lähdetään vartin yli neljä.
2 Saapuuko junasi aamu- vai iltakahdeksalta?
3 Matkustan Englantiin kesäkuun kuudentena.
4 Äitini 18. syntymäpäivä oli 15. joulukuuta 1990.
5 Työskenteleekö 25-vuotias serkkusi tutkijana yliopistolla?
6 Pyörä keksittiin 3500 ennen ajanlaskumme alkua.
7 Stephen Hawkingista tuli professori kolmekymppisenä.
8 Siskontyttäreni oli puolitoistavuotias kun hän oppi puhumaan.
Hän syntyi vuonna 2014.

Vuosikymmenet (decades)

	lue:
in the 1990s	in the nineteen nineties
in the 90s	in the nineties
in the 1690s	in the sixteen nineties
in the 2000s	in the early two thousands in the twenty hundreds
in the 2010s	in the twenty-tens
in the early 50s	50-luvun alkupuolella
in the mid-1980s	1980-luvun puolivälissä
in the late 2020s	2020-luvun loppupuolella
in the last/past two decades	parin viimeisen vuosikymmenen aikana

Vuosisadat (centuries)

		lue:
in the 19th century 1800-luvulla	in the 1800s	in the eighteen hundreds
in the 20th century 1900-luvulla	in the 1900s	in the nineteen hundreds
in the 21st century 2000-luvulla	in the 2000s	in the twenty hundreds

in the early 16th century	1500-luvun alkupuolella
in the late 20th century	1900-luvun loppupuolella
at the turn of the century	vuosisadan vaihteessa
at the beginning of the century	tämän vuosisadan alussa
at the end of the millennium	vuosituhannen lopussa

G26 Translate into English.

1 *Park Lane numero 199* oli brittiläinen TV-sarja 1960-luvun puolivälissä.
2 *Cats* oli ilmiö: sitä esitettiin Lontoossa vuodesta 1981 vuoteen 2002.
3 Vuonna 1993 tutkijat löysivät 3,5 miljoonaa vuotta vanhoja bakteereita Australiasta.
4 Vuosituhannen vaihteessa huomattiin, että 60% ihmisen geeneistä löytyy myös kärpäseltä.
5 Oireet ilmaantuivat vuorokauden kuluttua.

G27 Fill in the gaps according to the Finnish hints.

Inventions and innovations

1 Did you know that paper money was first used in China as early as _____ _____? (1000-luvulla)

2 I think that the most important invention _____ _____ (vuodelta 1182) is the magnetic compass.

3 I wonder how short-sighted people were able to see before eyeglasses were invented _____. (1200-luvun loppupuolella)

4 I did not know that mechanical scales originate _____ _____. (vuodelta 1366)

5 My uncle, who is a golf enthusiast, told me that golf balls were created _____ _____. (1400-luvulla)

6 Leonardo DaVinci designed a horizontal water wheel for water mills _____ _____. (1500-luvun alussa)

7 _____ (muutama vuosisata sitten) the concept of time was different from the way we see it these days; the pocket watch was only patented _____. (vuonna 1674)

8 _____ (1700-lukua kuvastaa, passiivi) characterised by the Industrial Revolution.

9 The first Western plastic surgery was performed in the UK _____ _____ (23.10.1814). Unfortunately there are no photographs of the patient, a young soldier, as photography was invented a little later, _____. (1820-luvulla)

G28 **Numbers are sometimes used as words. Listen to how the following numbers are used in spoken English. Fill in the gaps while listening. Work with a partner and take turns reading the sentences aloud.**

3-D or 3D	24/7	007	911	9/11
20/20	180°	4x4	4G	4–0

1 Finland played Canada last night. We won! The score was _____.

2 In the later _____ films, James Bond has to share the glory with clever computer programmers.

3 When my phone can't find a _____ network, it falls back on using good old 3G.

4 The emergency number in the US is _____.

5 She thought she needed _____ vision to become a pilot, but it turns out that pilots can wear corrective glasses.

6 CERN (the European Organization for Nuclear Research) operates the largest particle physics laboratory in the world, and it is guarded _____.

7 _____ printing is here to stay. Soon, all spare parts may be made using this layer-by-layer method of manufacturing.

8 You definitely do not need a petrol-guzzling _____ vehicle to drive around in cities.

9 She used to be a pacifist, but after _____ she did a _____ turn. Now she works for the weapons industry, designing missiles.

G29 Put each of the following words in its correct place in the sentences below.

dozens	even	cardinal	gazillion	ordinal	odd
two	plus	average	fold	round	-ish

1 1, 2, 3, 4, 5 etc. are _____ numbers.

1st, 2nd, 3rd, 4th, 5th etc. are _____ numbers.

2 2, 4, 6, 8, 10 etc. are _____ numbers.

1, 3, 5, 7, 9 etc. are _____ numbers.

3 There are _____ of language courses advertised in this brochure.

4 The students' ages vary. The _____ age is about 22.

5 OK, I'll lend you the £95 you need. Well, let's make it a _____ number. Here's £100.

6 Internet searches about bird flu have increased ten_____ since 2005.

7 How old is my teacher? I'd say fifty _____.

8 She was driving down Hämeenkatu at fifty _____ when the police stopped her.

9 When we got a new puppy biscuits started to disappear from the cupboard.

It didn't take us long to put two and _____ together.

10 Maya has a _____ reasons for not doing her homework.

Substantiivi ja prepositio
Noun + preposition

G30 **Listen to the dialogue. Fill in the noun and preposition. Then translate the noun + preposition phrases.**

– You should have more **1** _____ yourself.

– But I have very little **2** _____ doing any physics at all. I barely pass the exams.

– The main thing is to have an **3** _____ what you are doing. A **4** _____ theoretical science knowledge does not matter that much.

– My science teacher also emphasizes the **5** _____ applying what we learn in class.

– Do you have a good **6** _____ your science teacher?

– Yes, I do. He's a real **7** _____ things like chaos theory. I have a lot of **8** _____ him. I just don't understand what he's talking about!

– Well, I also had some **9** _____ my physics course, but now I'm studying advanced physics and I love it. My research topic is the Big Bang theory.

– You must be the **10** _____ the rule then. Most of us who struggle with science now won't become scientists later.

Joitain substantiiveja seuraa tietty prepositio. Niihin ei löydy sääntöjä, joten ilmaukset täytyy opetella ulkoa. Harjoittelu auttaa! Lista tavallisesti käytetyistä substantiivi + verbi -ilmauksista löytyy s. 233–234.

- Preposition jälkeen voi tulla substantiivi.
  I have a lot of **respect for researchers**.
- Kun prepositiota seuraa verbi, se on usein -ing muodossa
  Did you have any **difficulty in answering** the chemistry questions?

G31 Match the following sentences.

1 What would happen in an airplane if there was a sudden **decrease** _____
2 Does chemistry have any **influence** _____
3 Can **addiction** _____
4 In your school, is there an ongoing **debate** _____
5 Do you have **confidence** _____
6 Is there a **cure** _____
7 Can you explain the **difference** _____
8 What **effect** does _____

A **in** yourself when doing algebra?
B seeing a needle have **on** you?
C **between** blood vessels and veins?
D **on** the modern food and beverages industry?
E **to** sugar be cured?
F **about** the lab courses offered?
G **in** cabin pressure?
H **for** influenza?

Gazing at the stars.

G32 Choose the correct preposition. Check the preposition list for help.

1 Put your trust **with** / **in** / **for** me. I will protect you.
2 Robots are very efficient workers in comparison **with** / **for** / **against** normal people who need holidays and lunch breaks.
3 I doubt if there will ever be a widespread demand **at** / **after** / **for** driverless cars.
4 Freud's theories about the unconscious had a very big effect **after** / **on** / **for** Jung.
5 The arrival of the robots **at** / **–** / **on** the village hospital changed everything.
6 The development of Hyperloop travelling had a huge impact **after** / **–** / **on** the airline industry.
7 "Congratulations **on** / **at** / **for** the achievement of a lifelong dream," Dr Xo said to Lea.
8 Our arrival **to** / **at** / **in** London coincided with the demonstrations against designer babies.
9 There has been an indefinite delay regarding our departure **–** / **for** / **towards** Antarctica.
10 What is your opinion **of** / **at** / **in** designer babies?

G33 Translate the sentences into Finnish.

1 The general attitude towards female scientists in the 19th century was very negative.
2 But Marie Curie's father, a teacher in Warsaw, encouraged her love for science.
3 At the Sorbonne University in Paris, she made such an impression on the physics professor Pierre Curie that he married her.
4 Marie and Pierre became experts on radiation.
5 Marie's research into radioactive isotopes was especially important.

G34 Translate the sentences into English.

1 Vastaukseni toiseen kysymykseen oli väärä.
2 Rekan saapuminen tehtaalle viivästyi useita tunteja.
3 Hänen valituksensa biobussista levisi netissä.
4 Monilla keksinnöillä oli yllättäviä vaikutuksia ympäristöön.
5 Vitamiinien puute heikentää immuunijärjestelmääsi.

Noun + preposition

a	**addiction to**	riippuvuus	Our **addiction to** sugar is affecting our health.
	admiration for	ihailu	Her **admiration for** Dr Hawking was limitless.
	affection for	kiintymys	Mo had a strange **affection for** the little Martians.
	anger at	viha, suuttumus	His **anger at** his boss continued for two days.
	answer to	vastaus	Always choose the best **answer to** the question.
	arrival in/at	saapuminen (in: maa, iso kaupunki, at: muut paikat)	Our **arrival in** Beijing caused quite a stir. Ra's **arrival at** the factory coincided with the lunch break.
	attack on	hyökkäys	The drones' **attack on** the village was devastating.
	attitude to/towards	asenne	Have human **attitudes towards/to** robots changed?
c	**cause of**	syy, aiheuttaja	The **cause of** the accident is unknown.
	comment on	kommentti	Mia disagreed with Schrödinger's **comment on** cats.
	comparison with/to	vertailu	In **comparison with/to** human pilots, robots make fewer mistakes.
	complaint about	valitus	The **complaint about** the design was the first of many.
	confidence in	usko, luottamus	Kennedy said that he had **confidence in** the space programme.
	congratulation(s) on	onnittelu(t)	**Congratulations on** your 50th wedding anniversary.
	connection with/to	yhteys	Dr Venter's research on cloning goats has no **connection with/to** cloning babies.
	cure for	parannus, lääke	We have not yet found a **cure for** the common cold.
	debate about/on	väittely	The **debate about/on** human cloning went on until late at night.
	decrease in	vähentyminen	There has been no notable **decrease in** the level of noise.
	demand for	demand for	The **demand for** clean energy is increasing.
d	**departure for**	lähtö	The next **departure for** Cairo will be at eleven.
	dependence on	riippuvuus	Our **dependence on** oil will be our downfall.
	difference between	ero	The **difference between** you and me is that you like sugary drinks and I don't.
	difficulty in	vaikeus tehdä jtak	English students sometimes have **difficulty in** choosing the correct preposition.
	difficulty with	vaikeus jssak	Can you help me please? I'm having some **difficulty with** this maths problem.
e	**effect on**	vaikutus	Cutting out sugar will have a positive **effect on** your health.

	experience in/of	kokemus	Bryar has years of **experience in** the food industry. It was his first **experience of** travelling alone.
	exception to	poikkeus	There is an **exception to** every rule.
	expert in/on	asiantuntija	Dr Zony is our **expert in/on** radio communication.
f	**faith in**	usko, luottamus	Einstein had **faith in** humanity.
i	**ignorance of**	tietämättömyys	**Ignorance of** the law is no excuse in court.
	impact on	vaikutus	Max Planck had an immense **impact on** quantum theory.
	importance of	tärkeys	The sheik emphasized the **importance of** finding an alternative to crude oil.
	impression on	vaikutus	Freud's lecture made a big **impression on** Jung.
	increase in	lisääntyminen	We predict an **increase in** the sales of solar panels.
	influence on	vaikutus	The Curie family thought Pierre was a good **influence on** their daughter.
	insight into	oivallus, ymmärrys	Jung's essay provides a valuable **insight into** the value of dreams.
	interest in	mielenkiinto	Jung shared Freud's **interest in** dreams.
	interference in	sekaantuminen, puuttuminen	The Curies resented outside **interference in** their work on radioactivity.
l	**lack of**	puute	There is no **lack of** water on Mars – frozen water.
	love for	rakkaus	I feel more **love for** my robot than for my girlfriend.
n	**need for**	tarve	There is a pressing **need for** alternative sources of food.
o	**opinion on/about/of**	mielipide	What is your **opinion of/about** this new bio bus? Me? I don't have an **opinion about/on** the matter.
r	**reason for**	syy, perustelu	What is the reason **for** the strange phenomenon?
	relationship with/to	suhde	Anna had a close **relationship with** Freud. The answer had no **relationship to** the question.
	relevance to	merkityksellisyys	Her research covers an area of little **relevance to** modern life.
	research into/on	tutkimus	We need to do more **research on/into** cloning.
	respect for	kunnioitus	I have a lot of **respect for** the early astronauts.
	responsibility for	vastuu	The engineer took full **responsibility for** the burst pipe.
s	**satisfaction with**	tyytyväisyys	The researcher showed **satisfaction with** the results of her experiment.
	shortage of	puute	There is a **shortage of** water on the moon.
	solution to	ratkaisu	That is the perfect **solution to** all our problems!
t	**thanks for**	kiitos	Many **thanks for** your support!
	thanks to	ansiosta	It's **thanks to** Buzz Aldrin that I got the job at NASA.
	trust in	luottamus	Many people place a lot of **trust in** scientists.

Epäsäännölliset verbit · Irregular verbs

a	**arise, arose, arisen** [ə'raiz, ə'rəuz, ə'rizn]	nousta, syntyä, ilmetä
	awake, awoke, awoken/awakened [ə'weik, ə'wəuk, ə'wəukən/ə'weikənt]	herätä
b	**be, was/were, been** [biː, wɔz, wəəː(r), biːn]	olla
	bear, bore, borne [beə(r), bɔː(r), bɔːn] **born** = syntynyt	kantaa, kestää, sietää, synnyttää
	beat, beat, beaten [biːt, biːt, biːtn]	lyödä, voittaa
	become, became, become [bi'kʌm, bi'keim, bi'kʌm]	tulla joksikin
	begin, began, begun [bi'gin, bi'gæn, bi'gʌn]	alkaa
	bend, bent, bent [bend, bent, bent]	taivuttaa, taipua
	bet, bet/betted, bet/betted [bet, bet/betid, bet/betid]	lyödä vetoa
	bid, bid, bid [bid, bid, bid]	tarjota, tehdä tarjous (esim. huutokaupassa)
	bind, bound, bound [baind, baund, baund]	sitoa
	bite, bit, bitten/bit [bait, bit, bitn/bit]	purra, tarttua (onkeen)
	bleed, bled, bled [bliːd, bled, bled]	vuotaa verta
	blow, blew, blown [bləu, bluː, bləun]	puhaltaa, tuulla
	break, broke, broken [breik, brɔuk, brɔukn]	katkaista, murtaa, särkeä, murtua, särkyä
	breed, bred, bred [briːd, bred, bred]	kasvattaa, jalostaa (eläimiä, kasveja)
	bring, brought, brought [briŋ, brɔːt, brɔːt]	tuoda
	broadcast, broadcast, broadcast [brɔːdkɑːst, brɔːdkɑːst, brɔːdkɑːst]	lähettää (radiosta, TV:stä)
	build, built, built [bild, bilt, bilt]	rakentaa
	burn, burnt/burned, burnt/burned [bəːn, bəːnt/bəːnd, bəːnt/bəːnd]	palaa, polttaa
	burst, burst, burst [bəːst, bəːst, bəːst]	haljeta, särkyä, puhjeta, syöksyä, särkeä, puhkaista
	buy, bought, bought [bai, bɔːt, bɔːt]	ostaa
c	**cast, cast, cast** [kɑːst, kɑːst, kɑːst]	valaa, heittää (esim. varjo, katse)
	catch, caught, caught [kætʃ, kɔːt, kɔːt]	saada kiinni, ottaa kiinni, pyydystää
	choose, chose, chosen [tʃuːz, tʃəuz, tʃəuzn]	valita
	cling, clung, clung [kliŋ, klʌŋ, klʌŋ]	takertua, tarrautua, pitää kiinni
	come, came, come [kʌm, keim, kʌm]	tulla, saapua
	cost, cost, cost [kɔst, kɔst, kɔst]	maksaa, olla hintana
	creep, crept, crept [kriːp, krept, krept]	ryömiä, madella, hiipiä
	cut, cut, cut [kʌt, kʌt, kʌt]	leikata, hakata, kaataa

d	**deal, dealt, dealt** [diːl, delt, delt]	käsitellä, jakaa, antaa, käydä kauppaa, olla tekemisissä
	dig, dug, dug [dig, dʌg, dʌg]	kaivaa
	do/does, did, done [duː/dʌz, did, dʌn]	tehdä
	draw, drew, drawn [drɔː, druː, drɔːn]	vetää, piirtää, laatia
	dream, dreamt/dreamed, dreamt/dreamed [driːm, dremt/driːmd, dremt/driːmd]	uneksia
	drink, drank, drunk [driŋk, dræŋk, drʌŋk]	juoda
	drive, drove, driven [draiv, drəuv, drivn]	ajaa
	dwell, dwelt/dwelled, dwelt [dwel, dwelt/dweld, dwelt]	asua, oleskella
e	**eat, ate, eaten** [iːt, et /(AmE) eit, iːtn]	syödä
f	**fall, fell, fallen** [fɔːl, fel, fɔːln]	pudota, kaatua
	feed, fed, fed [fiːd, fed, fed]	syöttää, ruokkia
	feel, felt, felt [fiːl, felt, felt]	tuntea (olevansa), tuntua, tunnustella
	fight, fought, fought [fait, fɔːt, fɔːt]	tapella, taistella
	find, found, found [faind, faund, faund]	löytää
	flee, fled, fled [fliː, fled, fled]	paeta
	fling, flung, flung [fliŋ, flʌŋ, flʌŋ]	heittää, singota, paiskata
	fly, flew, flown [flai, fluː, fləun]	lentää
	forbid, forbade/(AmE) forbad, forbidden [fə'bid, fə'bæd/fɔ'beid, fɔ'bidn]	kieltää
	forget, forgot, forgotten/(AmE) forgot [fə'get, fə'gɔt, fə'gɔtn/fə'gɔt]	unohtaa
	forgive, forgave, forgiven [fə'giv, fə'geiv, fə'givn]	antaa anteeksi
	forsake, forsook, forsaken [fə'seik, fə'suk, fə'seikn]	hylätä, luopua
	freeze, froze, frozen [friːz, frəuz, frəuzn]	jäätyä, paleltua, palella
g	**get, got, got/(AmE) gotten** [get, gɔt, gɔt/gɔtn]	saada jtk, hankkia, tulla joksikin, saada tekemään, tehdyksi, päästä
	give, gave, given [giv, geiv, givn]	antaa
	go, went, gone [gəu, went, gɔn]	mennä, kulkea, matkustaa
	grind, ground, ground [graind, graund, graund]	jauhaa
	grow, grew, grown [grəu, gruː, grəun]	kasvaa, kasvattaa, tulla joksikin
h	**hang, hung, hung** [hæŋ, hʌŋ, hʌŋ]	riippua, ripustaa
	have, had, had [hæv, hæd, hæd]	omistaa, olla jllak
	hear, heard, heard [hiə(r), həːd, həːd]	kuulla, saada kuulla, saada tietää
	hit, hit, hit [hit, hit, hit]	iskeä, osua
	hide, hid, hidden [haid, hid, hidn]	piilottaa, piileskellä
	hold, held, held [həuld, held, held]	pitää, vetää (esim. astiasta), sisältää
	hurt, hurt, hurt [həːt, həːt, həːt]	loukata, tehdä kipeää

k	**keep, kept, kept** [kiːp, kept, kept]	pitää, säilyttää, pysyä, säilyä, tehdä jtk jatkuvasti
	kneel, knelt/kneeled, knelt/kneeled [niːl, nelt/niːld, nelt/niːld]	polvistua
	knit, knit/knitted, knit/knitted [nit, nit/nitid, nit/nitid]	kutoa, neuloa
	know, knew, known [nəu, njuː, nəun]	tietää, osata, tuntea
l	**lay, laid, laid** [lei, leid, leid]	panna (pitkälleen), laskea, asettaa, kattaa (pöytä)
	lead, led, led [liːd, led, led]	johtaa, viedä, taluttaa
	lean, leant/leaned, leant/leaned [liːn, lent/liːnd, lent/ liːnd]	nojata, nojautua
	learn, learnt/learned, learnt/learned [ləːn, ləːnt/ləːnd, ləːnt/ləːnd]	oppia, opetella, saada tietää, saada kuulla
	leave, left, left [liːv, left, left]	jättää, lähteä
	lend, lent, lent [lend, lent, lent]	lainata jllek, antaa lainaksi
	let, let, let [let, let, let]	antaa, sallia, päästää, vuokrata, antaa vuokralle
	lie, lay, lain [lai, lei, lein]	maata, olla, sijaita
	light, lit/lighted, lit/lighted [lait, lit/laitid, lit/laitid]	sytyttää
	lose, lost, lost [luːz, lɔst, lɔst]	kadottaa, menettää
m	**make, made, made** [meik, meid, meid]	tehdä, valmistaa, saada jk tekemään jtk
	mean, meant, meant [miːn, ment, ment]	tarkoittaa, merkitä, aikoa
	meet, met, met [miːt, met, met]	tavata, kohdata, tulla vastaan
	mistake, mistook, mistaken [mis'teik, mis'tuk, mis'teikn]	erehtyä (luulemaan jtk jksk), käsittää väärin
	misunderstand, misunderstood, misunderstood [misʌndə'stænd, misʌndə'stud, misʌndə'stud]	ymmärtää väärin
	mow, mowed, mown/mowed [məu, məud, məun/məud]	leikata (ruohoa)
o	**overcome, overcame, overcome** [əuvə'kʌm, əuvə'keim, əuvə'kʌm]	voittaa
	overtake, overtook, overtaken [əuvə'teik, əuvə'tuk, əuvə'teikn]	ohittaa
p	**pay, paid, paid** [pei, peid, peid]	maksaa, antaa maksuksi, kannattaa
	put, put, put [put, put, put]	panna, asettaa
q	**quit, quit, quit** [kwit, kwit, kwit]	lakata tekemästä, luopua, sanoutua irti
r	**read, read, read** [riːd, red, red]	lukea
	ride, rode, ridden [raid, rəud, ridn]	ratsastaa, ajaa (pyörällä), olla matkustajana
	ring, rang, rung [riŋ, ræŋ, rʌŋ]	soittaa, soida
	rise, rose, risen [raiz, rəuz, rizn]	nousta, kohota
	run, ran, run [rʌn, ræn, rʌn]	juosta, (kulkuneuvosta) kulkea, virrata, valua, johtaa, hoitaa (yritystä)

S

saw, sawed, sawn/sawed [sɔː, sɔːd, sɔːn/sɔːd] sahata
say, said, said [sei, sed, sed] sanoa
see, saw, seen [siː, sɔː, siːn] nähdä, ymmärtää
seek, sought, sought [siːk, sɔːt, sɔːt] etsiä, tavoitella
sell, sold, sold [sel, səuld, səuld] myydä, mennä kaupaksi
send, sent, sent [send, sent, sent] lähettää
set, set, set [set, set, set] panna, asettaa, laskea (auringosta)
sew, sewed, sewn/sewed [səu, səud, səun/səud] ommella
shake, shook, shaken [ʃeik, ʃuk, ʃeikn] ravistaa, pudistaa
shed, shed, shed [ʃed, ʃed, ʃed] vuodattaa, valaa, säteillä
shine, shone, shone [ʃain, ʃɔn, ʃɔn] loistaa, paistaa
shoot, shot, shot [ʃuːt, ʃɔt, ʃɔt] ampua, laukaista
show, showed, shown/showed [ʃəu, ʃəud, ʃəun/ʃəud] näyttää, osoittaa
shrink, shrank, shrunk [ʃriŋk, ʃræŋk, ʃrʌŋk] kutistua
shut, shut, shut [ʃʌt, ʃʌt, ʃʌt] sulkea, sulkeutua
sing, sang, sung [siŋ, sæŋ, sʌŋ] laulaa
sink, sank, sunk [siŋk, sæŋk, sʌŋk] upota, vaipua, upottaa
sit, sat, sat [sit, sæt, sæt] istua
slay, slew, slain [slei, sluː, slein] lyödä kuoliaaksi
sleep, slept, slept [sliːp, slept, slept] nukkua
slide, slid, slid [slaid, slid, slid] liukua
sling, slung, slung [sliŋ, slʌŋ, slʌŋ] sinkauttaa, paiskata, heittää
slit, slit, slit [slit, slit, slit] viiltää halki, haljeta
smell, smelt/smelled, smelt/smelled [smel, smelt/smeld, smelt/smeld] haistaa, haista, tuoksua
sneak, sneaked/(AmE) snuck, sneaked/(AmE) snuck [sniːk, sniːkt/snʌk, sniːkt/snʌk] hiipiä, pujahtaa
sow, sowed, sown/sowed [səu, səud, səun/səud] kylvää
speak, spoke, spoken [spiːk, spəuk, spəukn] puhua
speed, sped/speeded, sped/speeded [spiːd, sped/spiːdid, sped/spiːdid] kiitää, ajaa ylinopeutta, nopeuttaa, vauhdittaa
spell, spelt/spelled, spelt/spelled [spel, spelt/speld, spelt/speld] kirjoittaa, tavata
spend, spent, spent [spend, spent, spent] viettää, kuluttaa (aikaa, rahaa)
spill, spilt/spilled, spilt/ spilled [spil, spilt/spild, spilt/ spild] läikyttää
spin, spun, spun [spin, spʌn, spʌn] kehrätä, panna pyörimään, pyöriä
spit, spat/(AmE) spit, spat/(AmE) spit [spit, spæt/spit, spæt/spit] sylkeä
split, split, split [split, split, split] halkaista
spoil, spoilt/spoiled, spoilt/spoiled [spɔil, spɔilt/spɔild, spɔilt/spɔild] turmella, pilata, hemmotella

	spread, spread, spread [spred, spred, spred]	levittää, levitä, levittäytyä
	spring, sprang, sprung [spriŋ, spræŋ, sprʌŋ]	hypähtää, hypätä
	stand, stood, stood [stænd, stud, stud]	seistä, sietää, kestää
	steal, stole, stolen [stiːl, stəul, stəuln]	varastaa, hiipiä, livahtaa
	stick, stuck, stuck [stik, stʌk, stʌk]	pistää, kiinnittää, juuttua, pitäytyä
	sting, stung, stung [stiŋ, stʌŋ, stʌŋ]	pistää (jollakin terävällä)
	stink, stank/stunk, stunk [stiŋk, stæŋk/stʌŋk, stʌŋk]	löyhkätä, haista
	stride, strode, stridden [straid, strəud, stridn]	harppoa, kulkea pitkin askelin
	strike, struck, struck [straik, strʌk, strʌk]	lyödä, iskeä, tehdä lakko, juolahtaa mieleen
	strive, strove, striven [straiv, strəuv, strivn]	pyrkiä, ponnistella
	sweat, sweat/sweated, sweat/sweated [swet, swet/swetid, swet/swetid]	hikoilla, rehkiä, raataa
	swear, swore, sworn [sweə(r), swɔː(r), swɔːn]	vannoa, kirota
	sweep, swept, swept [swiːp, swept, swept]	lakaista, pyyhkäistä
	swim, swam, swum [swim, swæm, swʌm]	uida
	swing, swung, swung [swiŋ, swʌŋ, swʌŋ]	heiluttaa, heilua
t	**take, took, taken** [teik, tuk, teikn]	ottaa, viedä
	teach, taught, taught [tiːtʃ, tɔːt, tɔːt]	opettaa
	tear, tore, torn [teə(r), tɔː(r), tɔːn]	repiä
	tell, told, told [tel, təuld, təuld]	kertoa, sanoa, käskeä
	think, thought, thought [θiŋk, θɔːt, θɔːt]	ajatella, luulla, olla jotakin mieltä
	throw, threw, thrown [θrəu, θruː, θrəun]	heittää
	thrust, thrust, thrust [θrʌst, θrʌst, θrʌst]	työntää, sysätä, tunkeutua
	tread, trod, trodden [tred, trɔd, trɔdn]	polkea, tallata, astua
u	**undergo, underwent, undergone** [ʌndəˈgəu, ʌndəˈwent, ʌndəˈgɔn]	läpikäydä, joutua kokemaan
	understand, understood, understood [ʌndəˈstænd, ʌndəˈstud, ʌndəˈstud]	ymmärtää
	undertake, undertook, undertaken [ʌndəˈteik, ʌndəˈtuk, ʌndəˈteikn]	ryhtyä, ottaa tehtäväkseen
	upset, upset, upset [ʌpˈset, ʌpˈset, ʌpˈset]	järkyttää, panna sekaisin
w	**wake, woke/waked, woken/waked** [weik, wəuk/weikt, wəukn/weikt]	herättää, herätä
	wear, wore, worn [weə(r), wɔː(r), wɔːn]	käyttää, pitää (yllään), kuluttaa, kulua
	weave, wove, woven [wiːv, wəuv, wəuvn]	kutoa (kangasta)
	weep, wept, wept [wiːp, wept, wept]	itkeä
	win, won, won [win, wʌn, wʌn]	voittaa
	wind, wound, wound [waind, waund, waund]	vääntää (käyntiin), kiertää, kiemurrella, vetää
	withdraw, withdrew, withdrawn [wiðˈdrɔː, wiðˈdruː, wiðˈdrɔːn]	vetää pois, vetäytyä, nostaa (rahaa)
	wring, wrung, wrung [riŋ, rʌŋ, rʌŋ]	vääntää, väännellä
	write, wrote, written [rait, rout, ritn]	kirjoittaa

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Kannen kuva: Science Photo Library/MVPhotos

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triangle kolmio
rectangle suorakulmio
square neliö
circle ympyrä, kehä
sphere pallo
circumference kehä, ympärysmitta
oval soikio
cube kuutio
cone kartio
pentagon viisikulmio
horizontal line vaakaviiva
vertical line pystyviiva
diagonal line vinoviiva, lävistäjä
parallel lines samansuuntainen, yhdensuuntainen
angle kulma
curve käyrä, kaari
radius säde
diameter halkaisija, läpimitta

Front cover photo:
A scientist studying a selection of paper chromatograms of industrial dyes. Paper chromatography is an analytical method used to separate colored chemicals or substances. Paper chromatography involves placing a small amount of the substance under investigation on a piece of filter paper, then slowly dripping a solvent into the centre of the paper. The solvent then spreads out over the paper by capilliary action, carrying with it the components of the substance at differing rates. The distance travelled along the paper by each component during the time of the experiment is a measure of this characteristic transport rate and may be used to identify each component.

Chemistry humour

Why can you never trust atoms?

They make up everything.

Why did carbon marry hydrogen?

They bonded well from the minute they met.

Why did the acid go to the gym?

To become a buffer solution.

If H_2O is the formula for water, what is the formula for ice?

H_2O cubed.